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DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. MAIN REPORT. PART--ETC(U)

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Development
of
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in
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MAIN REPORT.
PART II • Volume 4b.
SUB-REGIONAL PLANS •
CHAPTERS 11 thru 12.

ORIGINAL CONTAINS COLOR PLATES: ALL
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DEVELOPMENT
OF
WATER RESOURCES
IN
APPALACHIA

MAIN REPORT
PART II
SHAPING A PLAN



CHAPTER 11 - WATER SUB-REGION F TODAY

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CHAPTER 11 - WATER SUB-REGION F TODAY

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CHAPTER 11 - WATER SUB-REGION F TODAY

SECTION I - THE REGION TODAY

1. POLITICAL

Water Sub-region F, which has been sub-divided into 3 water areas, is composed of 41 counties in four states - three in New York, 23 in Pennsylvania, 13 in West Virginia, and two in Ohio. Standard Metropolitan Statistical Areas within the sub-region include Erie and Pittsburgh in Pennsylvania; Steubenville-Weirton in Ohio and West Virginia; and Wheeling in West Virginia and Ohio. Metropolitan areas adjacent to Sub-region F include Youngstown-Warren, Ohio and Johnstown, Pennsylvania. Other urban centers within Sub-region F with populations of over 25,000 include: Jamestown, New York; Sharon, Pennsylvania; New Castle, Pennsylvania; Fairmont, West Virginia; and Clarksburg, West Virginia. There are 134 urban centers with over 5,000 population, and 72 with over 10,000 people. Counties and population centers are shown in Figure 11-1.

Numerous planning organizations have been developed in Water Sub-Region F centering on the problems found in the principal river basins. Examples of these are the Northwestern, North Central and Southwestern Local Development Districts sponsored by the Commonwealth of Pennsylvania. The programs of the Soil Conservation Service (thirty-three organized Soil Conservation Districts include all of the rural land in the sub-region except for Forest County in Pennsylvania) and the Economic Development Administration also have economic and political implications.

In addition to the state, county and urban governments and planning groups there are many special-purpose and quasi-public groupings which perform functions normally accomplished by political entities. Typical examples of their functions are: water supply, housing, urban renewal, sewage, parks and recreation, utilities, cemeteries, airports, health and hospitals, libraries, highways, street lighting and soil conservation. These units are quite flexible in their jurisdictional boundaries and as the organizational procedures are quite simple, they have increased rapidly in recent years. In many cases such specialized bodies are fostered by Federal and state cost sharing programs.

Of particular significance to the Appalachian Water Resources Survey are the many special purpose and public service districts organized under state law as legal entities of the state. Included in this group are soil conservation districts and watershed districts. These districts are locally organized and managed for the purpose of providing leadership and coordinating the efforts of state and Federal conservation and natural resource agencies.

This framework of organization forms collectively the means for marshalling the resources to accomplish the objectives of the Appalachian legislation and its economic development goals for water areas F-1, F-2, and F-3.

2. PHYSICAL

Physiography and Geology

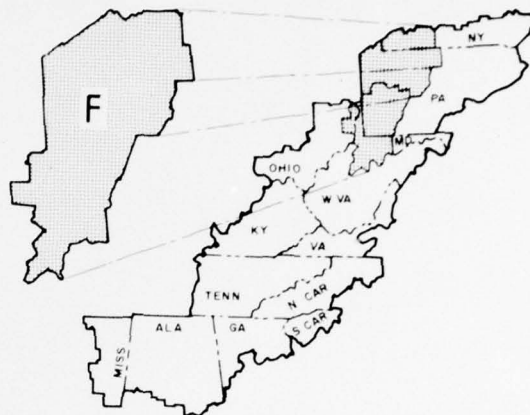
Sub-region F lies in the northern part of the Appalachian Region, covering 25,574 square miles in two physiographic provinces, the Appalachian Plateau and the Central Low Lands. The sub-region is elongated extending 310 miles from Gilmer County, West Virginia northeasterly to Allegany County, New York. The greatest width is about 140 miles in the upper Pennsylvania portion (Figure 11-2).

The Allegheny Mountains form the southeastern boundary of the sub-region. This area is basically rugged, heavily forested terrain with predominantly narrow, steep-sided valleys. Elevations vary from about 2,000 to 3,000 feet mean sea level, with local relief variations of 800 feet being common between the high ridges and the valley floors. These land forms have frequently led to isolated communities. The area is underlain by sedimentary rocks, primarily massive limestone, shale and sandstones which are essentially flat-lying and undistorted. Clays and coal also are present. It is significant to note that the coal deposits located in Southwestern and North Central Pennsylvania and Northwestern West Virginia have been of considerable importance in economic development. The major portion of the sub-region is situated within the Appalachian Plateaus Physiographic Province. The plateau topography is characterized by low, broad-topped hills with steep valley slopes. The northwestern portion in Western New York and Northwestern Pennsylvania is glaciated, with relatively more rugged topography south of the terminal moraine. The extent of the glacial action which formed this portion is indicated on Figure 11-2. North of this point, the great mass of ice shaped the topography into smooth, low-lying hills and in places created poorly drained soils and extensive areas of swamp and marsh lands, with many small lakes. Summit elevations in the plateaus vary from about 1,000 feet in the glaciated area to near 2,000 feet in the mountainous region.

The extreme northwestern portion of the sub-region is located within the Lake Erie Plain. The Portage Escarpment separates the Plain from the Appalachian Plateau, and roughly parallels the lake shore at distances varying from about 2 to 12 miles. The Plain is relatively flat, with elevations ranging from about 570 feet mean sea level at the lake shore to from 800 to 900 feet mean sea level at the base of the escarpment. Sedimentary rocks underlie this region.

In addition to the sub-region's outlet to the Great Lakes via Lake Erie (which it borders) and Lake Ontario, the major streams in the sub-region are the Genesee, Allegheny, Monongahela, Ohio, Beaver and the





VICINITY MAP

REPORT FOR
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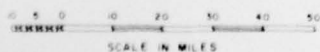
WATER SUB-REGION F

LOCATION MAP

OFFICE OF APPALACHIAN STUDIES JUNE 1968

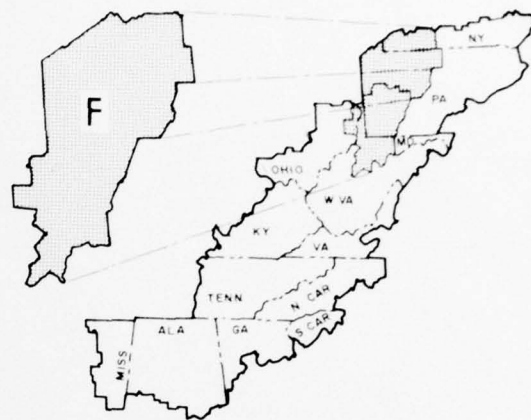
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FIGURE 11-1



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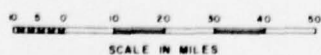


VICINITY MAP

LEGEND

- PRECIPITATION STATIONS
- ▲ STREAM GAGING STATIONS
- - - PHYSIOGRAPHIC BOUNDARY

CONTOUR INTERVAL - 600 FEET



REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION F

**PHYSICAL
FEATURES**

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-11-5

FIGURE 11-2

2

West Branch of the Susquehanna Rivers. Except for the Genesee River which rises in northwest Pennsylvania and courses north through New York to empty into Lake Ontario at Rochester, New York and the headwaters of the West Branch of the Susquehanna River within the sub-region, the remaining drainage elements are constituents of the Mississippi River via the Ohio River. The Allegheny River rises in north-central Pennsylvania. It flows north into New York and then turns southward into Pennsylvania, from whence it follows a generally southwesterly course to its confluence with the Monongahela River at Pittsburgh. The Monongahela River is formed at the confluence of the West Fork and Tygart Rivers at Fairmont, West Virginia. It flows in a northerly direction to its confluence with the Allegheny River at Pittsburgh. The Ohio River commences at Pittsburgh, at the confluence of the Allegheny and Monongahela Rivers. It flows northwest for a short distance, turning first to the west, and then to the south. It flows in a generally southwesterly direction for a distance of 981 miles, emptying into the Mississippi River at Cairo, Illinois. Only 127 miles of this length are within Sub-region F.

The strategic locations of the headwater areas of these several important river systems adds to the significance of plans to reduce soil erosion, acid discharge from mines, organic and nutrient pollution from cities and factories. Wise use of those headwater lands which will protect and enhance the natural water courses in the headwater areas should be encouraged.

Climate

The sub-region has the humid continental climate, with relatively short summers, generally associated with the northeastern area of the United States. Characteristic of the sub-region are recorded infrequent periods of uncomfortably warm weather and cold periods which are generally of short duration and not severe. Temperatures of 100°F. and higher have been recorded in July and August, with an average of about 15 days per year when temperatures are 90°F. or higher. The winters are moderately cold, with an average of 100 days or more in which freezing temperatures occur, while temperatures of 20°F. or more below zero have been recorded in the northern part nearly every winter. Winters are most temperate in the west-central part. Mean monthly temperatures range from a maximum of 70°F. in July to a minimum of 29°F. in January and February.

Precipitation has been, in general, ample and well distributed throughout the year. Rainfall in excess of 2.5 inches in 24 hours is infrequent. Extended periods of severe drought occur occasionally. The average annual precipitation is approximately 43 inches. (See Figure 11-3). At the higher altitudes precipitation occurring as snowfall is moderately heavy and lies on the ground for considerable periods during the winter months. The average annual snowfall ranges from about 50 inches in the southern areas to 90 inches in the north.

Storms during the cooler months tend to be associated with large low-pressure systems, and are usually widespread, of moderate intensity, and extended duration. On the other hand, warm period storms are generally of frontal, convective, or orographic origin, and tend to be intense, localized, and of shorter durations. Storms of tropical origin have reached the sub-region, although the extended travel over land masses, including mountain ranges, usually dissipate the circulatory systems so that such large amounts of precipitable moisture are usually substantially diminished in route. The storms which produce the more intense floods which have been recorded on smaller drainage areas are usually of the convective type, and are ordinarily quite localized.

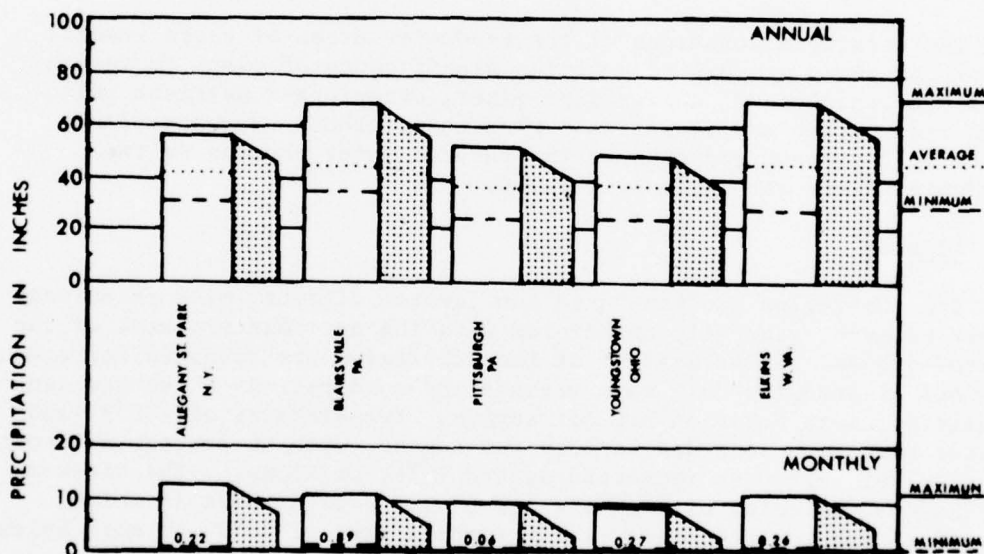


Figure 11-3 - Precipitation at Selected Stations.

Runoff

The largest amount of available water resource is reflected in an average annual runoff of nearly 20 inches. Runoff in the winter and spring is much greater than during summer and early fall, due to the interaction of snow melt and rainfall. Data from the following selected gage stations is representative of the area (See Table 11-1).

TABLE 11-1
ANNUAL RUNOFF AT SELECTED STATIONS

Stream and Station	Period of Record	D.A. (sq. mi.)	Annual Runoff (inches)		
			Average	Max.	Min.
Cattaraugus Cr. Gowanda, N.Y.	1940-66	432	22.0	32.7	14.6
Genesee River Scio, New York	1916-66	309	16.7	26.5	10.8
W. Br. Susquehanna R. Bower, Pa.	1913-66	315	23.5	41.3	12.7
Clarion River Cooksburg, Pa.	1939-66	807	23.5	34.8	16.1
Allegheny River Natrona, Pa.	1938-66	11,419	22.3	33.1	16.0
West Fork River Butcherville, W.Va.	1915-66	181	22.9	37.6	10.6
Monongahela River Braddock, Pa.	1938-66	7,342	22.4	31.0	12.9
Beaver River Wampum, Pa.	1932-66	2,235	14.0	24.3	5.0

The water resources of the sub-region, if properly managed, are generally adequate for all needs. The following table (Table 11-2) summarizes the flow characteristics for most of the major streams of the sub-region.

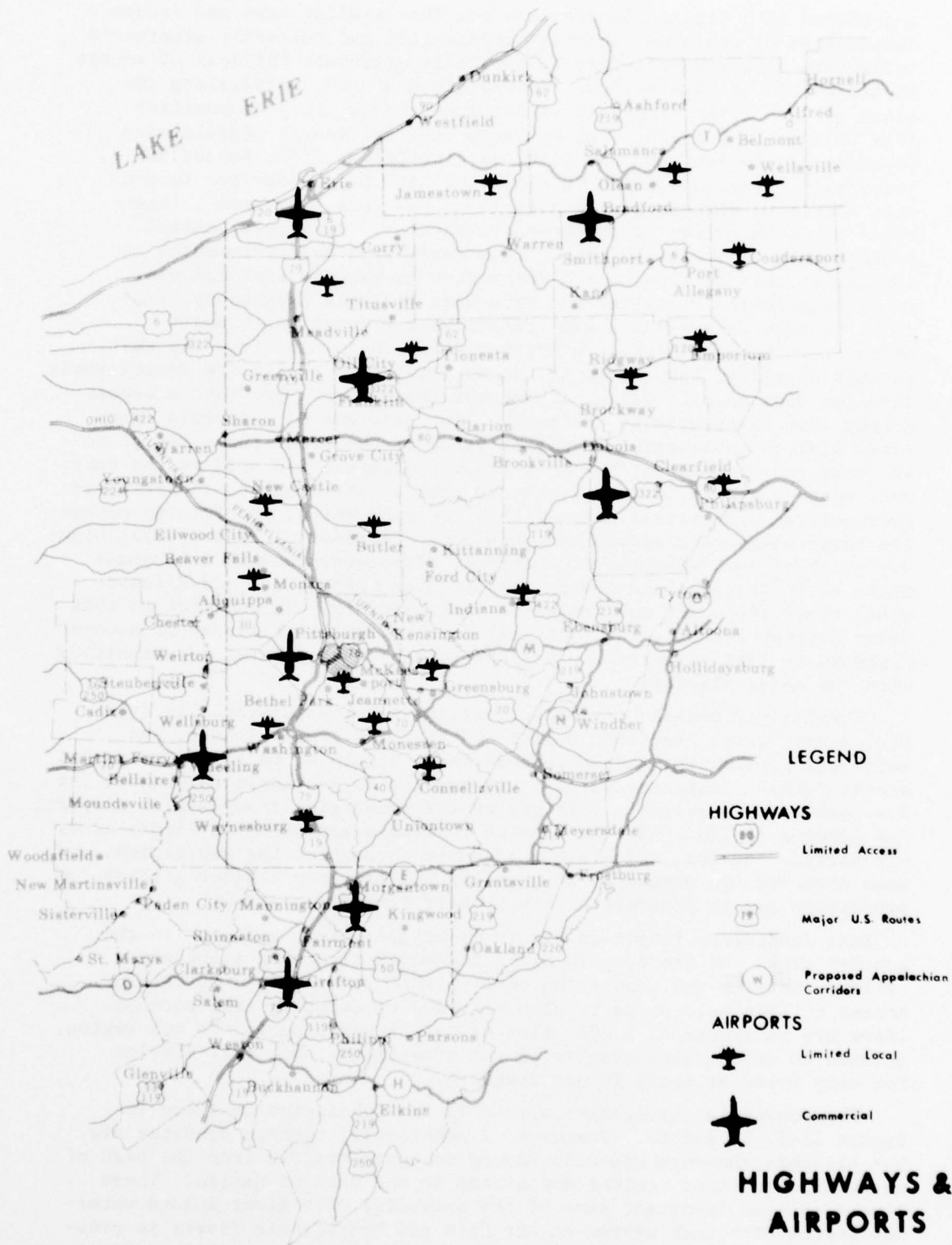
TABLE 11-2
FLOW OF STREAMS IN SUB-REGION F

Stream	Average	Extremes of	
	Flow (M.G.D.)	Flow (cfs)* Max.	Min.
ALLEGHENY RIVER BASIN			
Conewango Creek	1,010	14,400	57
Brokenstraw Creek	387	18,000	19
Oil Creek	350	12,000	23
Tionesta Creek	550	13,500	2
French Creek	1,325	23,800	43
Clarion River	1,407	50,000	11
Redbank Creek	587	35,200	19
Mahoning Creek	455	10,400	9
Crooked Creek	283	21,000	1
Kiskiminetas River	1,985	185,000	56
Allegheny River at Pittsburgh	12,450	365,000	2,500
MONONGAHELA RIVER BASIN			
Middle Fork River	221	10,900	0
Buckhannon River	424	13,000	1
Tygart River	1,675	22,500	129
West Fork River	863	36,500	4
Big Sandy Creek	280	30,000	0
Cheat River	2,110	160,000	99
Dunkard Creek	180	16,800	0
Casselman River	625	50,000	10
Laurel Hill Creek	171	10,900	2
Youghiogheny River	1,950	108,000	300
Monongahela River at Pittsburgh	7,900	210,000	700
BEAVER AND UPPER OHIO RIVER BASIN			
Shenango River	825	33,000	6
Neshannock Creek	211	6,690	4
Connoquenessing Creek	731	23,000	6
Beaver River	2,090	105,000	74
Raccoon Creek	129	10,000	5
Chartiers Creek	191	13,500	16
Ohio River at Sewickley	20,600	574,000	3,400

*With existing (1969) reservoirs in operation.

Transportation

The major population centers are interconnected by a system of highways (shown in Figure 11-4) which, although extensive, cannot be

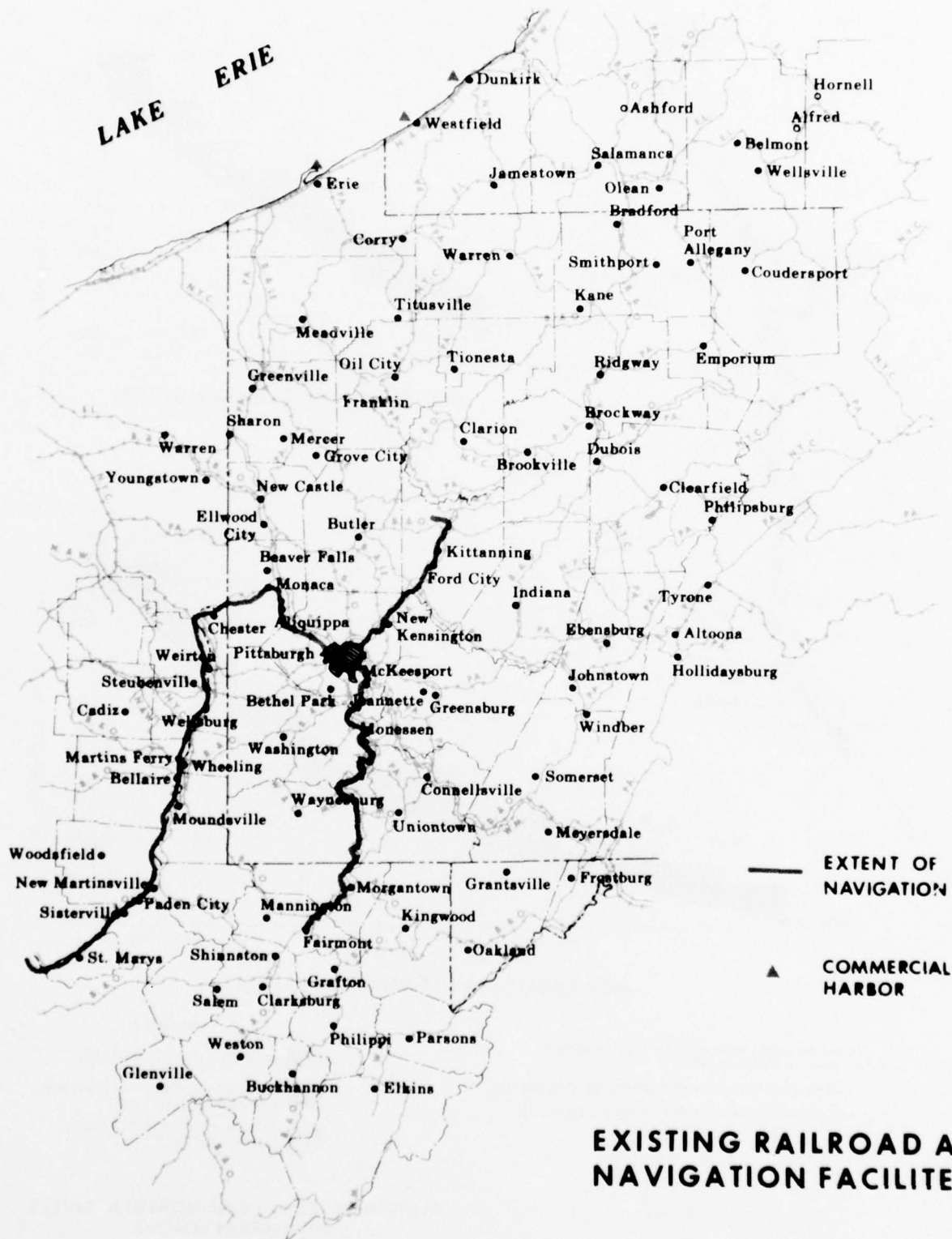


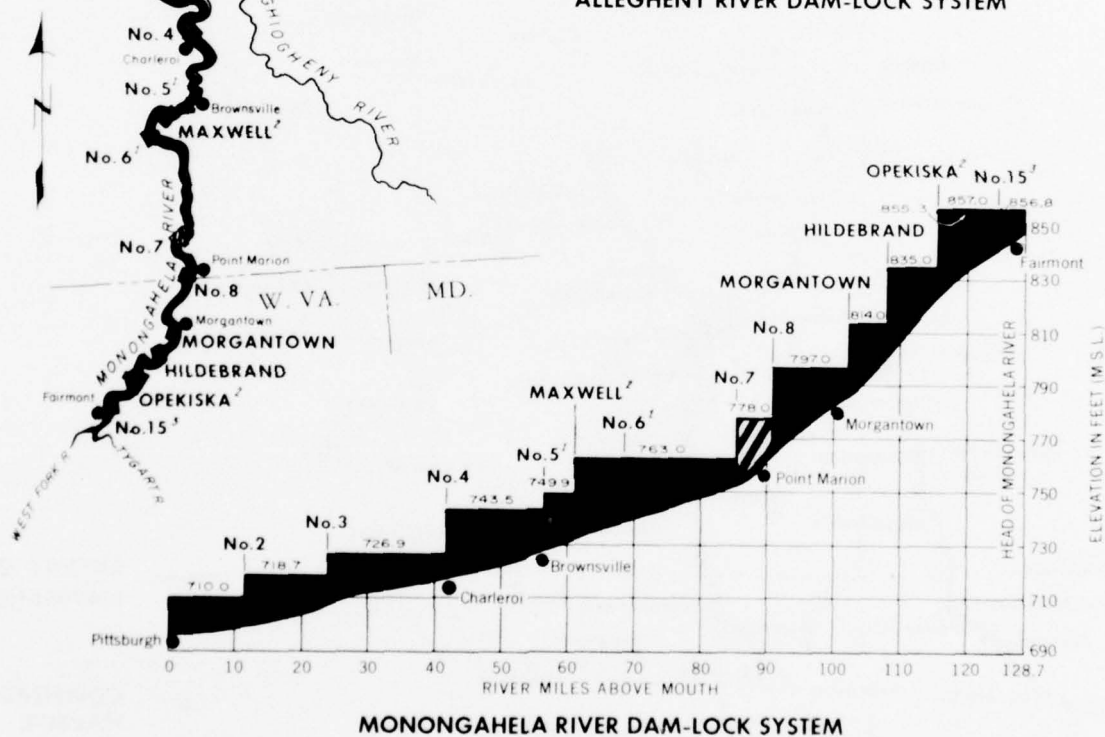
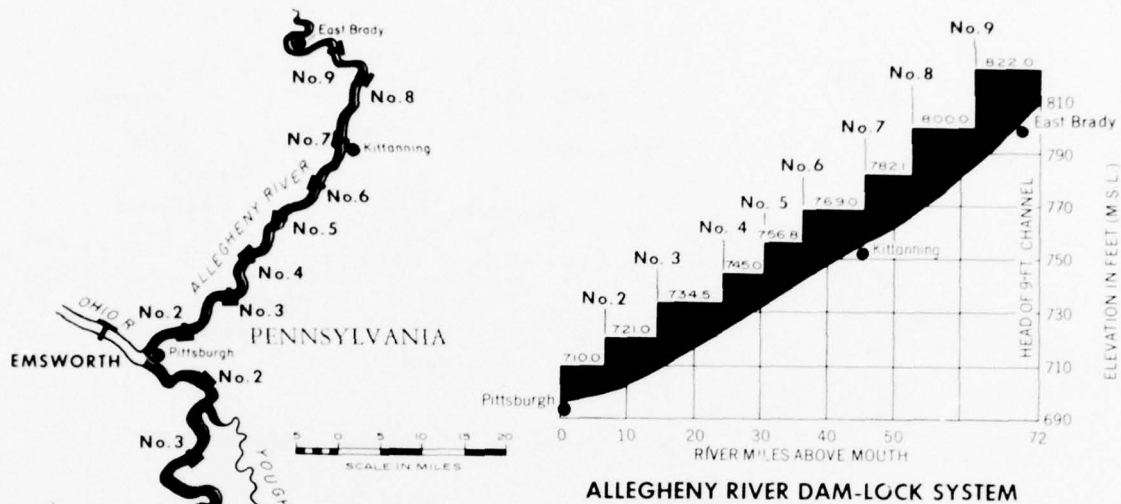
considered as sufficiently adequate for the existing size and economic development of the area. Recently constructed and currently programmed interstate highways will help to partially alleviate the lack of access to and within the sub-region. Interstate Route 90, paralleling the shore of Lake Erie, links all of the lower Great Lakes communities from Chicago to Buffalo. The Southern Tier Expressway (Appalachian Corridor T), in southern New York, originating at Erie, Pennsylvania, links with Interstate Route 90 along the Lake Erie shoreline to provide access to markets in the Buffalo to New York City area. Interstate Route 80, known as the Keystone Shortway, traverses central Pennsylvania from east to west. This route will be instrumental in opening up this portion of the sub-region to markets east and west. Interstate Route 79, called the Erie-West Virginia Expressway, provides western Pennsylvania and central West Virginia with major north-south highway link. Interstate Route 70 joining from the west, through Wheeling, West Virginia, to an intersection with the Pennsylvania Turnpike east of Pittsburgh, in Westmoreland County, provides a bypass around this major city to its south. The Ohio and Pennsylvania Turnpikes link the sub-region to market areas of the Great Lakes Region to the west and to those of New York and the Atlantic Seaboard to the east; and, with junctures to Interstates 70 and 79, interconnect the Standard Metropolitan Statistical Areas within the sub-region, and furnish access for these areas to a widespread populace. Corridor M, an east-west highway north of the Pennsylvania Turnpike, also connects with Interstate Route 70 in Westmoreland County, Appalachian Corridors D and E (east-west) cross the water sub-region in West Virginia. In addition to this major highway network, the need will develop for short feeder or access highways to link industrial areas and future developmental opportunities with the major highways.

Regularly scheduled commercial airline service is available from Pittsburgh, Erie, Bradford, Dubois and Franklin, Pennsylvania; and Wheeling, Clarksburg, and Morgantown, West Virginia, to all major market areas. Other limited commercial air service is available throughout the New York and Pennsylvania portions of the sub-region from smaller airports and landing fields. Airline service terminals are shown in Figure 11-4. Air service and facilities are inadequate throughout the sub-region, and some airports are presently approaching obsolescence. Major airline improvements are in progress at the Greater Pittsburgh Airport.

Rail facilities (shown in Figure 11-5) are mainly confined to the gentler slopes of the terrain along the major river and tributary valleys, serving the population centers which they helped to develop. Access to Lake Erie ports is also provided by existing rail service. There are in excess of 3,000 miles of rail trunk line in the sub-region, located to accommodate traffic in all directions. But rail service for many types of goods is not adequate.

The commercial navigation system in the sub-region is shown in Figure 11-5, 5a and 5b. Commerce of substantial tonnage operates via the Allegheny-Monongahela-Ohio Rivers to carry traffic from the head of navigation to major centers downstream to the Gulf of Mexico. These rivers form an important part of the extensive Ohio River inland waterway system. The lock system on the Ohio and Monongahela Rivers is presently approaching complete modernization which will improve the efficiency of water transportation in the southwestern portion of the sub-region.





¹ Current reconstruction of dam No. 4 and completion of Maxwell Dam will eliminate L & D's Nos. 5 and 6.

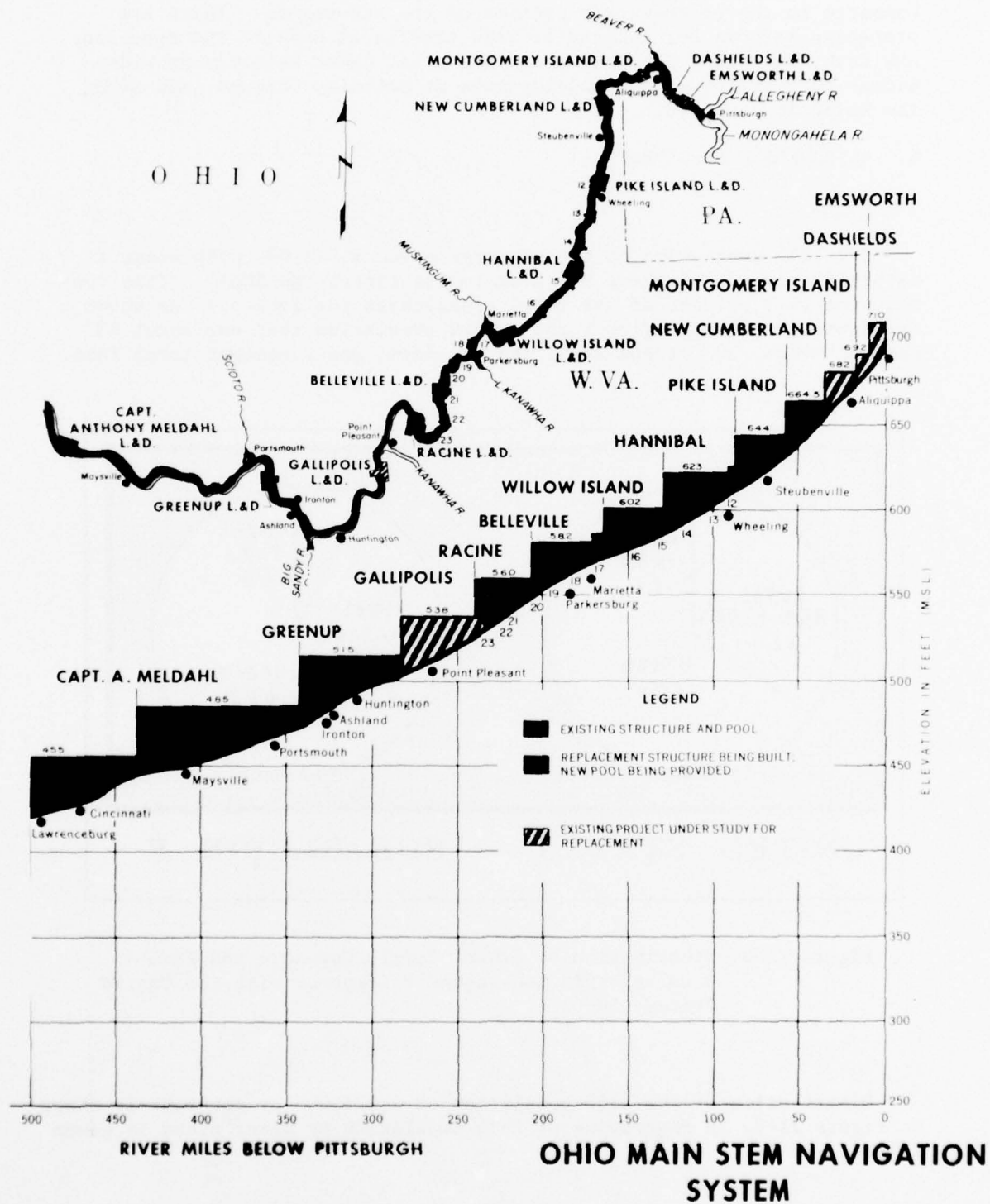
² Lock completed and in operation; pool raised to elevation shown.

³ Completion of Opekiska Dam will eliminate L & D No. 15.

LEGEND

- EXISTING STRUCTURE AND POOL
- REPLACEMENT STRUCTURE BEING BUILT, NEW POOL BEING PROVIDED
- EXISTING PROJECT UNDER STUDY FOR REPLACEMENT

ALLEGHENY AND MONONGAHELA RIVERS NAVIGATION SYSTEMS



Water transportation via Lake Erie is the only significant water commerce in the northwestern portion of the sub-region. There are protected harbors for commercial lake traffic at Dunkirk and Barcelona, New York, and Erie, Pennsylvania. The Great Lakes Waterway provides access to vast industrial developments at Detroit, Chicago, and along the Atlantic seaboard.

3. RESOURCES DEVELOPMENT

Human

The 1960 population of the sub-region was 4,771,000 with approximately 60 percent of these residing in the Pittsburgh SMSA. (This constitutes 16.3 percent of the total Appalachian population.) As shown in Figure 11-6, Sub-region F had a 1960 population that was about 63 percent urban, 30 percent rural and non-farm, and 7 percent rural farm.

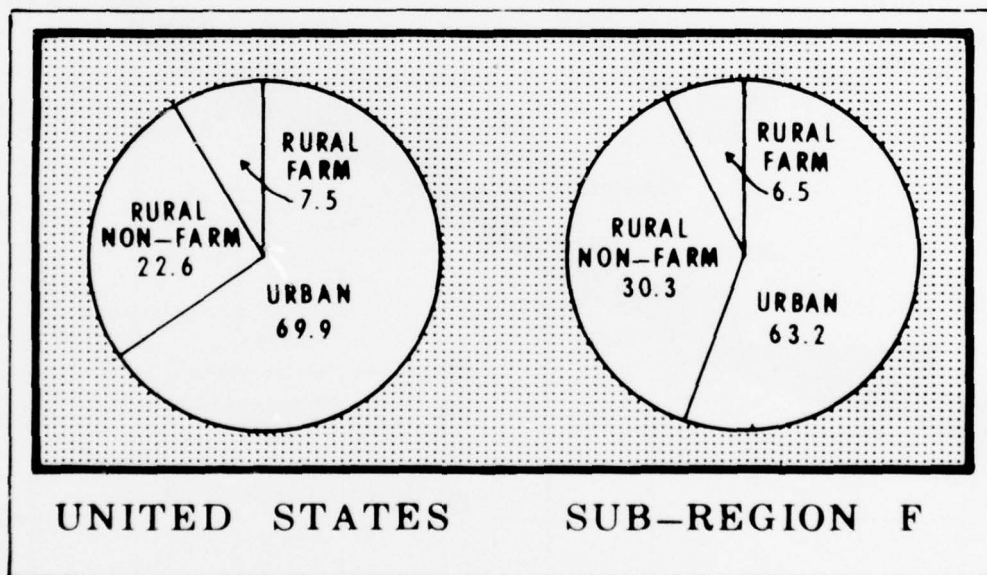


Figure 11-6 Distribution of Urban, Rural, Non-farm and Farm Population in Sub-region F Compared with the United States, 1960.

Distribution of the 1960 population of 4,771,000 by counties is shown in Figure 11-7. A regrouping of this population by water areas is given in Table 11-3.



Note - LESS THAN 1% NOT SHOWN

DISTRIBUTION OF 1960 POPULATION

PERCENTAGE OF TOTAL
FIGURE 11- 7

TABLE 11-3
POPULATION OF STATE PLANNING SUB-REGIONS

State Planning Sub-regions*	Water Area	Population 1960 Census
New York SPSR 1**	F-1	269,542
Pennsylvania SPSR 4	F-1	721,891
SPSR 6	F-1	244,240
SPSR 5	F-2	2,883,729
West Virginia & Ohio SPSR 17***	F-3	377,445
SPSR 18	F-3	274,164
Total Sub-region F		4,771,011

* See Figure 11-18 for State Planning Sub-region location.

** Chautauqua, Cattaraugus and Allegany Counties only, remaining 3 counties from New York SPSR 1 in Sub-region B.

*** Two Ohio counties, not in State Planning Sub-region 17 (Jefferson County in SPSR 11 and Belmont County in SPSR 12) are included in the population total given for SPSR 17.

Large, predominantly urban areas are located in the Pittsburgh, Erie, Steubenville-Weirton and Wheeling State Planning Sub-regions. State Planning Sub-regions 6 and 18 are predominantly rural with State Planning Sub-regions 4, 17 and the portion of New York State Planning Sub-region 1 in Sub-region F, almost equally split between urban and rural.

Characteristics of the population in the areas are similar to population age grouping in the United States. The male-female relationship is in about the ratio of 49 to 51 percent. Figure 11-8 depicts population by age groups.

Educational level statistics for 1960 indicate about forty percent completing 1-8 years of elementary education; about 46 percent completing 1-4 years of high school, and about 12 percent completing one or more years of college, which compares with 37.4 percent, 43.8 percent, and 16.5 percent for the United States, respectively (See Figure 11-9). Nationally, 41 percent of the population over 25 years of age have at least a high school education. Of the four states involved in the sub-region, only the two Ohio counties, with 42 percent, are above this national level, while New York, Pennsylvania, and West Virginia have attained 40, 30 and 30 percent, respectively. In Sub-region F the average educational attainment of the urban population does not greatly exceed that of many rural areas of the United States. This large and poorly trained urban population is one of the major impediments to economic progress in this sub-region. The locations of Higher Educational Facilities are shown in Figure 11-10.

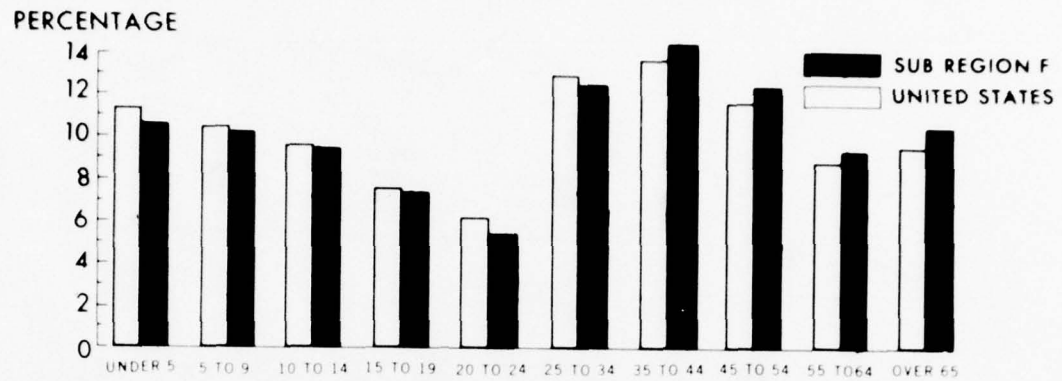


Figure 11-8 Percentage of Population by Age Group, 1960.

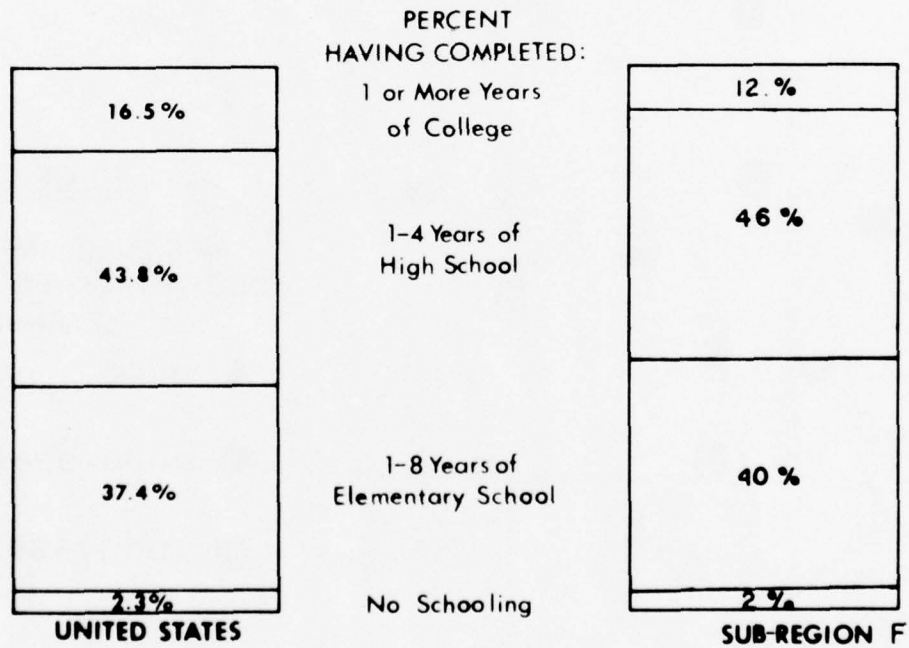
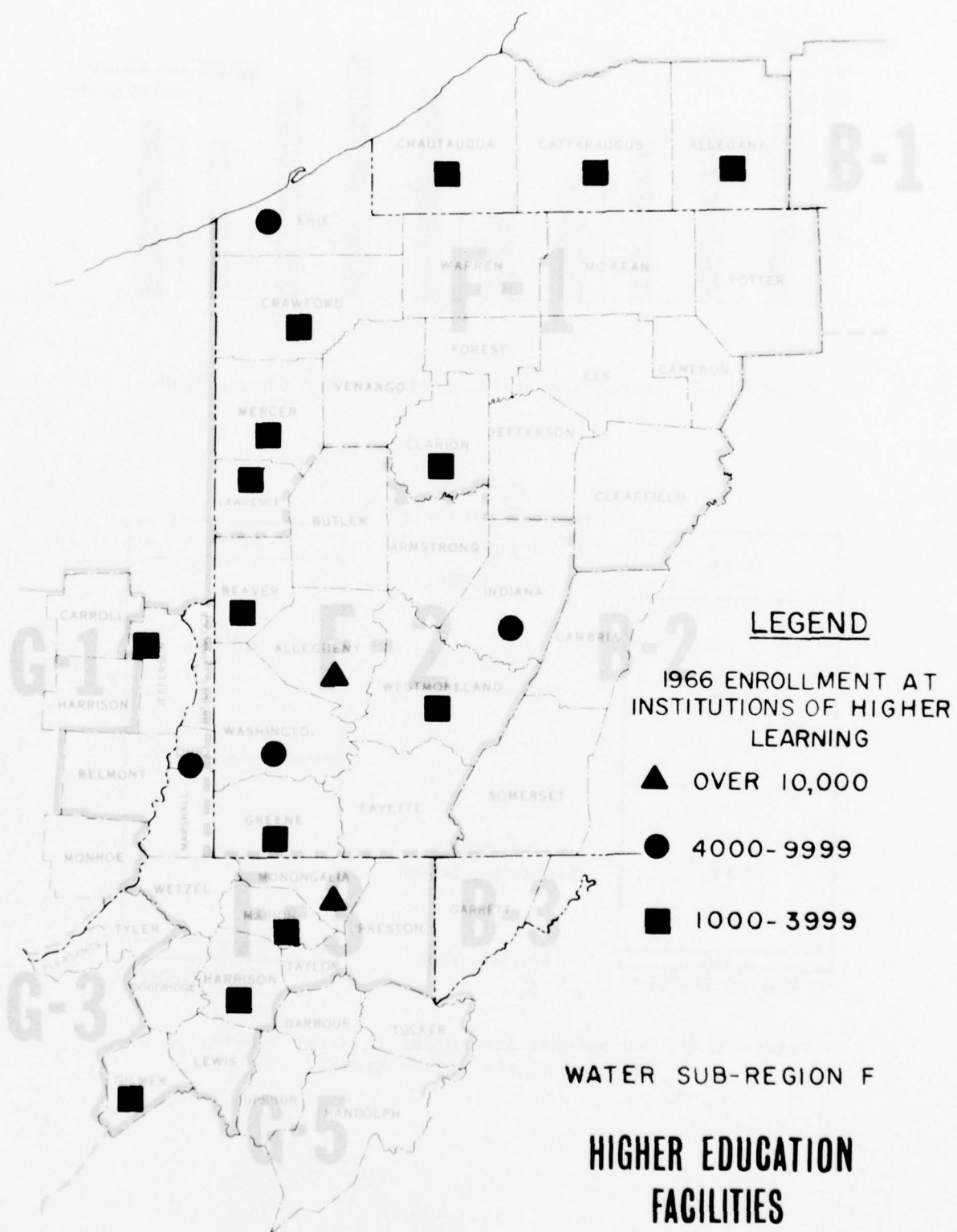


Figure 11-9 Educational Attainment in Water Sub-region F Compared to the United States.



Minerals

There are abundant mineral resources in the sub-region.*/ Heavily endowed with coal, petroleum and natural gas, this region has built an economy based upon heavy industry, steel production being the most important single element. Coal retains its position as the basic raw material essential to many of the sub-region's industries.

Rock and mineral raw materials and products, the mineral fuels, and water constitute the principal source from which in 1965 more than \$3 billion in derived commodities were produced in the four-state area which encompasses the sub-region. A large share of this, about 26 percent, is attributable to the sub-region, judging from the wide occurrence of these materials in the water area. Bituminous coal, with recoverable reserves exceeding 30 billion tons, is currently extensively mined in Water Areas F-1, F-2 and F-3 with long-term implications for mine-mouth power installation and the need for metallurgical coal by the iron and steel industry. Natural gas and natural gas liquids flow into the economic stream from all three water areas, as do petroleum, cement, sand and gravel, stone, lime, and clay. Water Areas F-1 and F-3 also contribute salt and peat, and Water Area F-1, iron oxide pigment.

Aside from water, coal is the principal mineable mineral resource. More than 25 percent of the National bituminous coal tonnage was mined here in 1965. In addition to accounting directly for wages and salaries, the industry also contributed to the economy through its purchases of materials and equipment, and furnishes the raw material for feeding the numerous power plants of the sub-region. It is estimated that about 60 percent of the total coal production is consumed in the generation of electrical power.**/ This will probably increase with the wider use of mine-mouth installations such as those constructed in Water Areas F-2 and F-3. Long-term contracts and commitments for fuel for new thermal electric generating plants and steel mills indicate that coal will be used principally for this purpose through the year 2000. Attendant to this, and other industrial uses of coal by burning, is the production of large quantities of fly-ash, which presents a disposal or assimilation problem. However, this material possesses characteristics which may make it adaptable to the sub-region's many pollution and mine subsidence problems.

Production of fluid hydrocarbon fuels -- petroleum, natural gas, and natural gas liquids -- continues to be a sizable industry. In 1965, the value of fluid hydrocarbons produced was \$78 million (10 percent of the total mineral value produced), of which petroleum was valued at \$35.5 million, and natural gas liquids valued at \$4.9 million. Fluid

*/ Appendix I, Mineral Industry - Resources and Water Requirements, U.S. Bureau of Mines.

**/ U.S. Bureau of Mines, op. cit.

hydrocarbons are rated second in value to bituminous coal. Reserves are equal to about 20 years production at the present depletion rate. Possibilities of oil and gas in deeper strata are being considered, along with more intensive recovery methods.

Although limestone is the most important stone mined or quarried, its occurrence is mainly confined to the central portion of the sub-region. Reserves in terms of quantity are adequate for present and anticipated future needs, and the quality is satisfactory for construction uses and for use in cement manufacturing. Sandstones are widely distributed, and reserves are adequate for any foreseeable demands of the construction industry.

Sand is in adequate supply throughout the sub-region, but the reserve of gravel is limited. However, any deficiencies in the area's supply of natural gravel could be met within the area by the substitution of crushed stone, or near the iron and steel producing areas, by crushed blast furnace slag. Products involved in quarrying include cement, lime, crushed stone, sand and gravel. Limestone and dolomite as quicklime, hydrated lime and finely ground limestone are employed extensively in the treatment of sewage plant effluent, acidic industrial wastes, acid mine water, public water supplies, reclamation and treatment of lakes and streams, and air pollution abatement.

At least 5 percent of the portland cement manufacturing capacity of the eastern United States is provided by five plants in the sub-region. A predominant share of the cement produced, estimated to exceed two-thirds of production, is also consumed by the construction industry in the sub-region.

Lands

The land area of the sub-region totals 16,368,000 acres (about 25,000 square miles), of which present agricultural and forest land acreage is 15,328,000 and other acreage is 1,040,600. The present land use acreage is as follows: cropland 3,065,300, pasture 2,076,000, state and private forest and woodland 7,899,000, and other land 1,809,000. In addition, there are 477,800 acres of National Forest land in the sub-region. The other land includes Federal land, urban and built-up areas and water area. The present land use is shown in Figure 11-11 and public and Federal land holdings are shown in Figure 11-12.

The rugged topography in southwestern Pennsylvania has limited the sites for towns and industry to narrow valley bottoms and the flood-plains and terraces of major rivers, especially in the more highly developed southwestern portion. These natural obstacles have limited urban expansion, increased population density, restricted circulation, and confined industrial location and expansion. The steep hills and ravines have caused a far more fragmented and intermingled pattern of residential, commercial and industrial land use than is characteristic

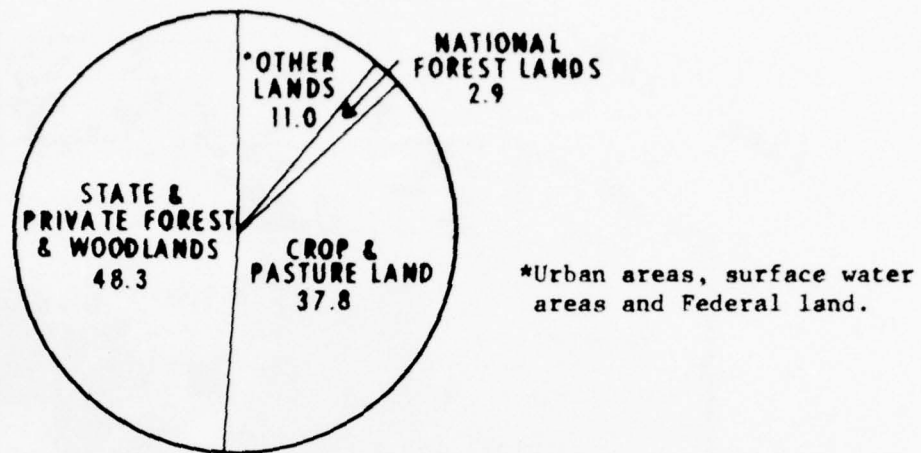


Figure 11-11 Land Use in Water Sub-region F.

of most urbanized areas in the sub-region.*/ The land usage pattern is checkerboard in design with transitions to adjacent neighborhoods frequent and abrupt. Rather large areas exhibit this broken up and mixed land use pattern. The topographic breaks in the land use pattern sometimes act as buffers between incompatible land uses such as between heavy industry and residential or recreational areas. Particularly with respect to the Pittsburgh area, hemmed in on all sides by the wide Allegheny, Monongahela and Ohio Rivers and contiguous steep hillsides, the central business district is confined to a relatively small triangle of land upon which is concentrated a vast economic development. In the southwestern portion of the sub-region only about 12 percent of all of the land is occupied by urban-oriented land use. Of the balance, about one-half is undevelopable due to steep slopes and strip mining activity.

By contrast in the northwestern portion of the sub-region a different land use pattern exists. Residential land is the largest single land use type, with almost one-half of the occupied land devoted to this purpose. These residential uses occupy large areas of land at relatively low densities. However, land use devoted to commercial development and industrial plants is competitive with residential (and recreational) needs for central locations or other sites with particular transportation or locational advantages. Residential growth, therefore, takes place on the outskirts of the urban area where relatively inexpensive land is available. In the Erie area, about 12

*/ Historical Analysis of the Region; Southwestern Pennsylvania Regional Planning Commission.

percent of the total land in urban use is devoted to industrial activities including transportation, utilities and communication as well as manufacturing. In this respect, there is a similarity to land use in the Pittsburgh area.

Land use is restricted in many parts of the sub-region by strip mining and subsidence. Large areas of abandoned strip mines with land deeply scarred and devoid of vegetation cover some 300,000 acres. This particular hindrance to land use exists in the southwestern portion of the sub-region, extending from east to west, namely Greene, Washington, Allegheny, Beaver, Butler, Indiana, Armstrong, Venango, Clarion, Jefferson and Clearfield Counties of Pennsylvania. Subsidence is another hindrance to land use. This is a particularly serious problem in areas where subsidence over underground mines has already occurred. It is also a seriously potential problem in portions of the sub-region in urbanizing areas where the coal has not yet been mined, but is held in ownership by major coal companies, and is likely to be mined in the near future. Under present Pennsylvania requirements, coal cannot be mined under built-up areas without leaving support pillars. In addition, the Commonwealth administers a mine-subsidence insurance program.

Total surface water area in the sub-region amounts to 144,900 acres or about 0.7 percent of the total land area. Of this surface water area, major reservoirs and rivers comprise 81,700 acres (0.4%) and small reservoirs less than 40 acres in size and streams less than one-eighth mile wide, amount to 63,200 acres (0.3%). This latter area includes farm ponds and small upstream watershed structures for recreation, fish and wildlife, irrigation, and water supply which amounts to 18,630 acres. A restoration program is under way on state-owned lands in Pennsylvania on areas that have no outstanding mineral rights.

Subsurface water occurs in the unconsolidated glacial-alluvial deposits in the major river and tributary valleys in the northern part and in the intergranular pore space and fracture zones of the consolidated rocks in the southern part of the sub-region. Ground water yield at about 90 percent stream flow duration varies between 0 and 350,000 gallons per day per square miles as shown in Figure 11-13.

Individual wells properly located and constructed in the alluvium along the Ohio River, in the western part of the sub-region will produce more than 600 gallons per minute. Throughout most of the remainder of the sub-region, the wells will produce between 300 and 600 gpm except in the southern part where the yield is less than 300 gpm. Ground water production characteristics are shown in Figure 11-14. For further discussion of groundwater resources see Appendix H, prepared by U.S. Geological Survey.

Although agriculture in the sub-region is declining and is expected to contribute relatively little to the sub-region's potential for economic growth, this type of land use covers an extensive part of the sub-region's total land area. Therefore, it is agriculture's importance



MAXIMUM YIELD OF WATER WELLS
GALLONS PER MINUTE

as a land use, rather than as an economic endeavor, which is a factor of consideration with respect to the sub-region's future. Characteristics of this resource are fully covered in Appendix A, Agriculture, Forestry and Conservation. As stated the total agricultural and forest land in the sub-region is 15,328,000 acres. This acreage is expected to decrease to approximately 14,929,100 acres by 1975. The expected reduction in agricultural and private forest land will be mainly due to increase in either Federal or state-owned land, land occupied by reservoirs or land converted to urban development.

Highest quality agricultural soils are scarce, constituting only about one percent of the land in the sub-region. Soils with some limitations for agricultural use occupy about 18 percent of the area and soils where many limitations to agriculture occur, occupy about 30 percent of the area. Soils on the remaining 51 percent of land in the sub-region offer little prime agricultural potential. About 11 million acres in Sub-region F have been surveyed and mapped for soil characteristics.

There were 8.4 million acres of land in farms in 1949, but by 1964 that total was down to 5.9 million acres. On this land there are about 45,000 farms having an average size of about 135 acres. Cropland comprised by far the largest acreage of any single type of farmland each census year (about 40 percent), but the trend was steadily downward from 4.0 million acres in 1949 to 2.6 million acres in 1964, for a reduction of 35 percent. All other types of farmland acreage followed the same general trend. The decline in total farm acreage and numbers and concurrent increase in average farm size experienced in the sub-region are part of a national trend. These changes are the result of higher yields and more efficient farm production through improved technology and ever increasing farm mechanization. These adjustments have occurred with accelerated rapidity throughout most of Appalachia, where the natural, inherent handicaps of mountainous terrain keep the region's agriculture at a comparative disadvantage with that of the nation's better farming areas. The trends in this sub-region are expected to continue. Urban and highway expansion have contributed to shifting land out of agriculture. Such adjustments are also expected to continue.

About one-half of the sub-region is in forest and woodland. The principal forest cover types are oak-hickory and maple-beech-birch. The present cover serves reasonably well to hold the soil in place. However, past misuse, land clearing, heavy livestock grazing, poor timber cutting practices and forest fires have destroyed much of the humus and the organic matter in the upper surface layer of the soil. These conditions have left one-third of the forest land in poor hydrologic condition and have materially reduced its capacity to absorb and store precipitation. About 95 percent of the forest land has a high to medium potential to improve hydrologically with proper management and protection.

Forest lands are well suited for timber production. Almost every acre, or about 98 percent of the forest land, is capable of producing

commercial timber. The Conservation Needs Inventory*/ indicates an increase in forest acreage of about 629,000 acres between 1958 and 1975. Many species comprise the total growing stock which, in 1962, amounted to about 9.65 billion cubic feet. Most of the acreage increase will come from abandoned crop or pastureland.

Many commercial timber species, both softwoods and hardwoods, are found. No single species or small group of species comprise the total growing stock which amounts to about 9.65 billion cubic feet.

Environmental Aspects

The sub-region contains a number of areas with scenic beauty of such quality as to make them a unique part of the national heritage. There are also areas of historical interest worthy of national attention. Many additional areas of less significance, but with potential for public enjoyment have been provided by the Federal, state and local governments in the form of reservoir impoundments. A public consciousness is growing in the sub-region for preservation of valuable natural features and historical landmarks. Fish and wildlife habitat are guarded zealously. Programs for open space preservation and optimal use and conservation for scenic and recreational opportunities are seriously considered by many planning agencies. The most mountainous areas of the sub-region, offering scenic beauty rarely equaled elsewhere, have a potential for use as major recreation areas. The river valleys of the major stream, in good part, contain regions of scenic beauty and potential future recreation.**/ There is a vast array of natural points of historical and ecological interest. Some of these have been developed by the National Park Service as focal points for extensive visitation.

The forests which occupy about 50 percent of the land area are quite scenic. Many of the forested areas are under consideration by the states and the U.S. Departments of Interior (Bureau of Outdoor Recreation) and Agriculture (U.S. Forest Service), for development of access and multiple-purpose recreation opportunities in their future plans. Streams at many locations feature scenic gorges, glens and waterfalls. There are located in the Ohio River drainage, features such as the Chautauqua Gorge and Cucumber Falls; and in the Great Lakes drainage, features such as the Genesee Gorge (often referred to as the Grand Canyon of the East). Other points of scenic beauty are known to the local conservancy agencies. These attractions include scenic beauty, nature, recreation and historical appreciation. As an example, the Pennsylvania State Supplement***/ and its new statewide outdoor recreation study, illustrate the Commonwealth's developmental program for full realization of these resources. To compliment these endeavors, a Conservation Education Center is under

*/ See Appendix A.

**/ See Appendix F, Recreation and Aesthetics, U.S. Bureau of Outdoor Recreation for full development.

***/ Pennsylvania State Water Supplement, Part V, Main Report.

development by Clarion State College (Pa.) and the Commonwealth at Sandy Lake in realization of a need for an educational opportunity relative to promoting and disseminating conservation standards and practices for the sub-region's ecology. The Center will be completed early enough to be considered as an existing program facility. West Virginia, New York and Ohio have in preparation similar studies to take advantage of developable opportunities in this sub-region as environmental enhancements. Many of these are prepared for early implementation.

All of the states in the sub-region are developing and programming new state parks (see Figure 11-12) to add to the existing water and natural resource base for recreation and preservation of areas of scenic, geologic, and historic importance. In addition to the State provided facilities, picnicking, fishing, boating, swimming, camping and boat launching facilities provided by the Federal Government are shown in Figure 11-15.

The forest tracts and areas of agricultural land, intermingled with the woodland, offer extensive wildlife habitat.*/ Aquatic wildlife also finds a large amount of suitable habitat, being available at natural lakes and reservoirs, ponds and streams. Sport fishery population in many streams, particularly in the northern part of Water Area F-1, including Lake Erie, is a constant source of recreation and enjoyment; cold and cool water streams, and reservoirs suitable for sustaining trout, small-mouth bass, walleyed pike, muskellunge and yellow perch are common here. Water quality control endeavors will undoubtedly enhance the fish and wildlife population and the enjoyment of their pursuit in the future in the water areas where pollution is a problem. Several of the existing Federal reservoir and watershed impoundments are influencing fish populations, especially in Water Area F-2. Fish and wildlife potential is believed to be unmatched and furnishes a desirable and an attractive base for satisfaction of increased pressure.

Most of the shore of Lake Erie is wooded and there are many scenic bluffs overlooking the lake. The lake is a popular tourist and resort area. It is used extensively for water supply, all types of recreation and commercial and sport fisheries. This latter activity is provided by finfish species which include smelt, yellow perch, and walleye. More fishermen utilize the lake than ever before. In general, the sport fishing in Lake Erie can be termed as good and it supports a large number of recreational fishermen.

Wildlife resource areas are extensive, and the resource itself is moderate to high in abundance. The resource consists of forest and farm game species, including deer, squirrel, grouse, rabbit, wild turkey, quail and bear. Even so, hunting opportunity has been experienced as only of adequate amount generally and can be improved. Hunting pressures on big game habitat is exerted from the larger metropolitan areas,

*/ See Appendix G, Fish and Wildlife, for full development.

1968

WATER and WOODLANDS For Your Enjoyment

U.S. Army - Corps of Engineers
The Pittsburgh District
Recommends

U.S. Army Engineer



District, Pittsburgh



II-11-31

FIGURE 11-15

principally Water Area F-2. As a result, the quality of hunting is impaired to some extent by crowding and by the existing limited access to the rather primitive areas which are located mainly in Water Area F-1, and the mountainous areas of F-3. Extensive waterfowl habitat areas are in the development stage in Pennsylvania.

Many streams and valleys in the area possess unique and outstanding characteristics which are associated with wild and scenic river possibilities. State and Federal consideration of these streams, wholly or in part, or in combination with existing and potential reservoir impoundments would enhance the natural resource appreciation opportunities described above. There are also archaeologic, historical and natural science*/ points of interest, and trail systems which are available. (See Figure 11-16.) Scenic easements for development of these purposes are desirable possibilities for enhancement of this potential.

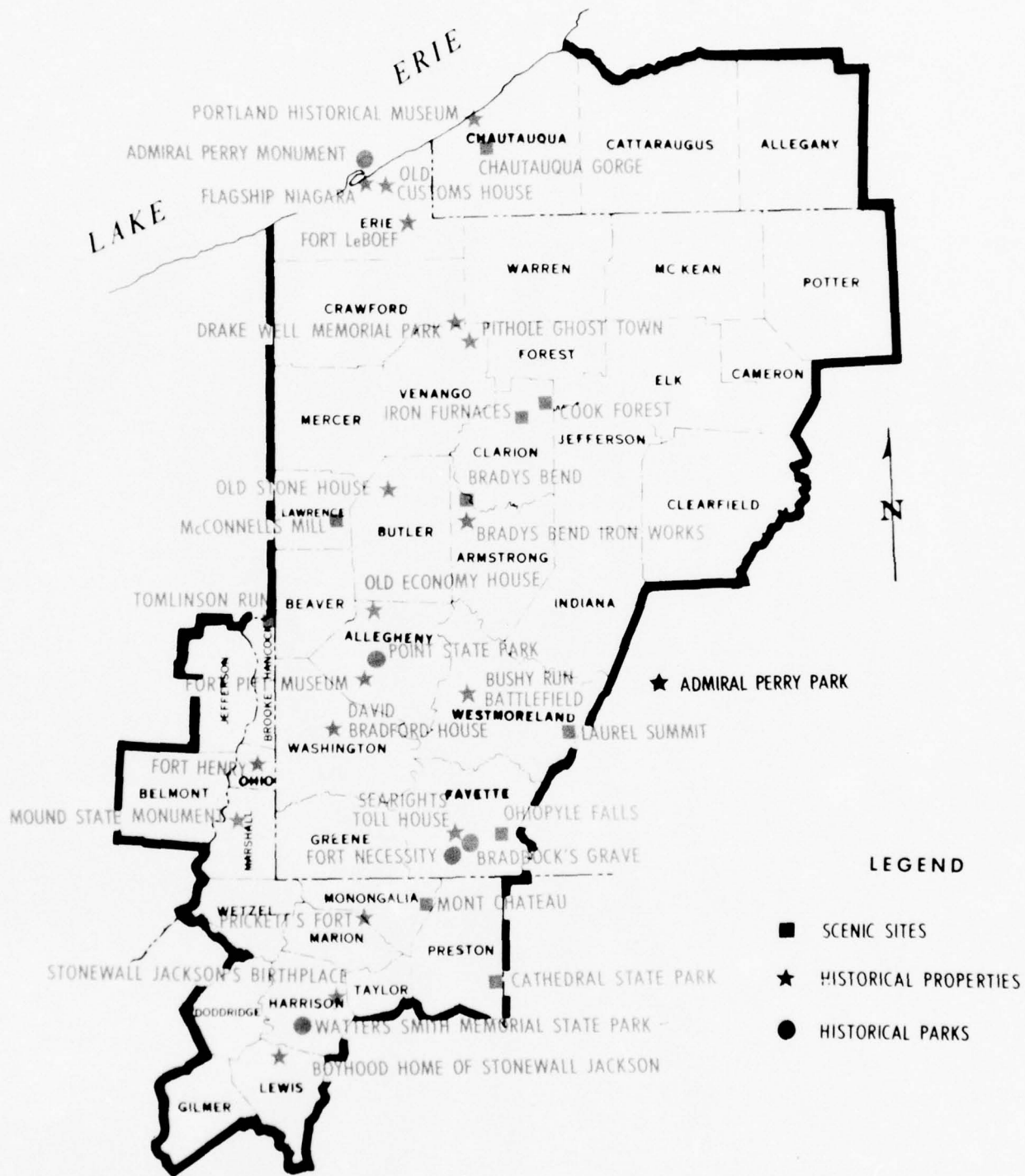
Recent Congressional action (Wild and Scenic Rivers Act, Public Law 90-542) has provided the means for establishing and maintaining certain river and stream reaches in their natural, free flowing, undisturbed state. Those nominated for possible designation as such in Sub-region F are:

1. Allegheny River from the mouth at Pittsburgh to East Brady, Pa.
2. Clarion River from its mouth to Ridgeway, Pa.
3. Youghiogheny River from Oakland, Maryland to Youghiogheny Reservoir and from Youghiogheny Dam to Connelsville, Pa.
4. Little Beaver River**/ from East Liverpool, Ohio upstream to Negly, Ohio on the North Fork and Elkton, Ohio on the Middle Fork.

Objectives of the most far reaching consequence are embodied in the State coordinated Appalachian Highlands Recreation Study which has the dual purpose to recommend a strategy of recreational development that will bring the most significant benefits to the people of the area in increased incomes and employment while, at the same time, meeting national goals for the conservation and preservation of our precious scenic and natural resources. Many of Pennsylvania Counties of the sub-region (Warren, McKean, Potter, Elk, Forest, Clarion, Clearfield, Cameron, and Fayette) and Cattaraugus County, New York are expected to reap a bonanza of benefits from potential tourist/recreation areas designated in this study. Progress in this effort will be subject to limited funds,

*/ See Appendix F, Recreation and Aesthetics, U.S. Bureau of Outdoor Recreation, for full development.

**/ See tributary to Ohio River located just west of Sub-region F.



SCENIC AND HISTORICAL SITES

FIGURE 11-16

but the expectation is that the complete study will be available as a base for initiation of investments prior to 1980.

While Sub-region F has many plus factors when the total environment is considered, there has been much damage to the natural setting in various areas involving relatively small acreages. The larger cities have become unattractive in many instances and the outskirts contain many land uses which detract from the natural beauty of the area. Water and air pollution from industry are commonplace, although serious attempts (supported by active research programs) are being made to combat the situation. Lake Erie has been polluted to a serious degree near ports and where polluted streams enter it. This situation is under active consideration by New York, Ohio and Pennsylvania for amelioration measures, although unanimity of interest may never be achieved. There is much soil erosion due to mining techniques and to improper land use. Practices for which controls are now in effect, or sought, have progressed to the point where there is a serious downgrading of the environmental quality. Acid mine drainage has turned many streams yellow and in many instances reduced their capacity to support and reproduce aquatic and plant life.

Water Resources Development - Federal

Corps of Engineers

Reservoir Projects. The Corps of Engineers will have completed by 1980, a total of 16 reservoirs in Sub-region F on French Creek and on the Allegheny, Clarion, Shenango, Beaver, West Branch Susquehanna, Cheat and West Fork Rivers. Three additional reservoirs, in the Mahoning Creek Basin, are located outside of, but exert considerable influence on Sub-region F. Most of the projects are primarily for flood control, but water supply, water quality control, hydropower and/or recreation are also included in many of the completed projects. Pertinent data on the reservoir projects are shown in Table 11-4 and their location in Figure 11-17, on Page II-11-47.

Local Protection Projects. In addition to flood control provided by the reservoir projects, there are also 25 local protection projects built by the Corps of Engineers in Water Sub-region F. Pertinent data for these projects are shown in Table 11-5 and depicted in Figure 11-17.

Navigation. The upper portion of the Ohio River is located in Sub-region F and contains about 126 miles of navigable water. There are also harbors for commercial lake traffic on Lake Erie. In addition, both the Allegheny and Monongahela Rivers have been made navigable for a distance of 62.6 and 115.4 miles, respectively. Pertinent data for the developments are shown in Tables 11-5 and 11-6. Their locations are shown on Figure 11-17. (Also Figures 11-5a & b.)

Beach Erosion Control Project. A cooperative beach erosion control project consisting of seawalls, groins, and beach replenishment along the lakeward shore of Presque Lake Peninsula was completed in 1956. Additional major nourishment of the sand beach has been completed since then.

U.S. Department of Agriculture

Completed Watershed Projects. Five upstream watershed projects have been completely installed. These watersheds comprise an area of 46 square miles. A total of 20 retarding and multi-purpose reservoirs controlling 20.2 square miles and 7.6 miles of channel improvement have been installed. The reservoirs contain 419 acre-feet of storage for sediment, 4,967 acre-feet for flood prevention, 77 acre-feet for municipal and industrial water supply and 3,780 acre-feet for fish and wildlife.

The estimated installation cost for the structural measures in the five watersheds total about \$1.54 million in addition to \$471 thousand for land treatment measures. Average annual flood water damages before projects were installed totaled an estimated 187,200 dollars. The average annual benefits from the installation of the projects are estimated to be 113,500 dollars. Watershed development is portrayed in Figure 11-17 and pertinent data is shown in Table 11-7.

Approved Watershed Projects. An additional 11 upstream watershed projects have been approved and are being installed. These watersheds comprise an area of 1,235.3 square miles. A total of 93 retarding and multi-purpose reservoirs with a drainage area of 626.8 square miles and 26.4 miles of channel improvement. The reservoirs contain 9,297 acre-feet of storage for sediment, 90,423 acre-feet for flood prevention, 300 acre-feet for municipal and industrial water supply, 10,510 acre-feet for recreation and 22,903 acre-feet for fish and wildlife.

The estimated installation cost for the structural measures in the 11 watersheds totals about \$26.2 million with an additional \$7.1 million for land treatment measures. Average annual flood water damages before project installation are estimated to be 1,410,800 dollars. The average annual benefits from the installation of the projects are an estimated 1,769,700 dollars. Pertinent data for the watershed projects are shown in Table 11-7.

Land Use Programs. The land use, treatment, and management programs of the various U.S. Department of Agriculture agencies are contributing significantly to improve water quality of the sub-region by reduction of erosion and sediment. Basic conservation plans are being put into effect for about 2,672,000 acres by over 21,000 landowners and operators cooperating with their local soil and water conservation districts. To date, a total of 1,603,800 acres, or 10 percent of land in the sub-region, have been adequately treated through the application and installation of conservation practices needed to meet its planned use, improvement, and protection. State and Federal cooperative forestry safety and improvement programs cover the entire sub-region. Appendix A discusses the U.S. Department of Agriculture programs in detail.

TABLE 11-4
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION F

Item	Alleghe- neve Reservoir	Tionesta Reservoir	Crooked Cr. Reservoir	E. Br. Clarion Reservoir	Mahoning Cr. Reservoir	Conemaugh Reservoir	Loyalhanna Reservoir	Shenango R. Reservoir	Berlin Reservoir*	Mosquito Cr. Reservoir*
LOCATION: Stream	Alleghe- neve River	Tionesta Creek	Crooked Cr. River	Clarion R.	Mahoning Cr. River	Conemaugh River	Loyalhanna River	Shenango R.	Mahoning River	Mosquito Cr.
River Mile	198	1.2	6.7	7.3	21.6	7.5	4.5	0.8	10.0	13.3
County(ies) & State	Warren & McKean, Pa. & Cattaraug- us, N.Y.	Forest, Pa.	Armstrong, Pa.	Elk, Pa.	Armstrong, Pa.	Indiana & Westmore- land, Pa.	Mercer & Trumbull, Ohio	Mahoning & Portage, Ohio	Trumbull, Ohio	Portage, Ohio
STATUS: Date of Completion	Complete 1965	Complete 1945	Complete 1949	Complete 1958	Complete 1949	Complete 1957	Complete 1951	Complete 1965	Complete 1951	Complete 1951
Authorized Purposes	FC,LF,R,P	FC,R	FC	FC,LF,R	FC	FC	FC	FC,LF,R	FC,LF,WS,R	FC,LF,WS,R
DRAINAGE AREA (sq. mi.)	2,180	478	277	72	340	1,351	290	589	249	97
ELEVATION (ft. above msl.):										
Top. Flood Control Pool	1365.0	1170.0	920.0	1685.0	1162.0	975.0	975.0	919.0	1032.0	904.0
Top. Conservation Pool,	1328.0	1085.0	840.0	1670.0	1075.0	880.0	910.0	896.0	1024.7	901.4
Maximum										
Top. Conservation Pool,	1292.0	-	-	-	-	-	-	-	-	-
Minimum	1240.0	-	-	1555.0	-	-	-	885.0	980.0	881.0
BOTTOM OF DRAWDOWN										
STORAGE (1,000 ac. ft.):										
Flood Control, Maximum	940.0	125.6	89.4	38.7	69.7	270.0	93.3	180.9	55.8	33.0
Flood Control, Minimum	607.0	-	-	19.0	-	-	-	151.0	32.8	21.7
Water Supply	-	-	-	-	-	-	-	-	19.4	11.0
Water Quality Control	-	-	-	-	-	-	-	-	-	-
Low Flow Aug.	549.0	-	-	64.3	-	-	-	29.9	37.2	69.4
Power	-	-	-	-	-	-	-	-	-	-
Other	24.0	7.8	4.5	1.0	4.5	4.0	2.0	11.5	1.8	2.0
TOTAL:	1180.0	133.4	93.9	84.3	74.2	274.0	95.3	192.4	91.2	104.1
SURFACE AREA (acres):										
Top. Flood Control Pool	21,180	2,770	1,940	1,370	2,370	6,820	3,280	11,090	5,500	8,900
Top. Conservation Pool,	12,080	480	350	1,160	170	300	210	3,560	3,590	7,850
Maximum										
POWER INSTALLATION (Hydro):										
Capacity (1,000 KW)	330	-	-	-	-	-	-	-	-	-
No. Units	2	-	-	-	-	-	-	-	-	-
YIELD:										
Water Supply (mgd)	-	-	-	-	-	-	-	-	-	-
Water Quality (cfs)	-	-	-	-	-	-	-	-	NA	13
Low Flow Aug. (cfs)	1,400	-	-	180	-	-	-	75	200	130

* Outside of Sub-region F.

TABLE 11-4 (cont'd)
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION F

Item	LOCATION: Stream	West Br. Reservoir*	Tygart Lake	Youghiogheny R. Reservoir	French Cr. Reservoir	Union City Reservoir	Woodcock Cr. Reservoir	Muddy Cr. Reservoir	Stonewall Jackson Reservoir	Rowlesburg Lake	Curwensville Reservoir
River Mile County(ies) & State		West Br., Mahoning River 10.6	Tygart Lake 22.7	Youghiogheny River 74.2	French Cr. 71.5	Union City Reservoir Erie, Pa. 4.1	Woodcock Cr. Reservoir Crawford, Pa. 4.1	Muddy Cr. Reservoir Crawford, Pa. 9.4	Stonewall Jackson Reservoir Lewis, W. Va. 73.0	Rowlesburg Lake 45.0	Curwensville Reservoir Clearfield, Pa. 0.6
STATUS:		Complete 1966	Complete 1945	Complete 1950	U.C. FC, R	FC, R	FC, LF, R	FC, WS, R	FC, LF, WS, R, FWL	Auth. W. Va. 936	Complete 1965 FC, LF, R 365
Date of Completion		1966	1945	1950	FC, R	FC, R	FC, LF, R	FC, WS, R	FC, LF, WS, R, FWL	Auth. W. Va. 936	Complete 1965 FC, LF, R 365
Authorized Purposes		FC, LF, WS, R	FC, LF, R	FC, LF, R	FC, R	FC, R	FC, LF, R	FC, WS, R	FC, LF, WS, R, FWL	Auth. W. Va. 936	Complete 1965 FC, LF, R 365
DRAINAGE AREA (sq. mi.)		80	1,184	434	222	222	46	61	102	936	365
ELEVATION (ft. above msl):		993.0	1167.0	1470.0	1278.0	1278.0	1209.0	1205.0	1082.0	1632.0	1228.0
Top, Flood Control Pool		985.5	1094.0	1439.0	1250.0	1250.0	1180.0	1183.0	1073.0	1601.0	1162.0
Top, Conservation Pool,											
Minimum		951.0	1010.0	1344.0			1162.0				
Bottom of Drawdown											
STORAGE (1,000 ac. ft.):											
Flood Control, Maximum		33.2	278.0	151.0	46.2	46.2	18.9	18.9	39.2	299.6	119.3
Flood Control, Minimum		22.0	178.1	99.5	39.1	39.1	15.2	16.4	27.0	250.8	114.7
Water Supply											
Water Quality Control											
Low Flow Aug.		54.9	99.9	149.3			3.8	2.5	46.2	571.5	9.4
Power											
Other		3.8	9.7	5.2	1.3	1.3	1.0	0.5	2.0		
TOTAL:		78.7	287.7	254.0	47.5	47.5	20.0	19.4	75.2	831.7	124.2
SURFACE AREA (acres):											
Top, Flood Control Pool		3,240	3,430	3,570	2,280	2,280	775	1,188	3,290	9,140	3,020
Top, Conservation Pool,											
Maximum		2,650	1,740	2,840	580	580	325	350	2,530	7,175	790
POWER INSTALLATION (Hydro):											
Capacity (1,000 kw)											
No. Units											
YIELD:											
Water Supply (mgd)		23						NA	NA	NA	
Water Quality (cfs)											
Low Flow Aug. (cfs)		100	350	600			75		55		

* Outside of Sub-region F.

TABLE 11-5
SUMMARY OF PERTINENT DATA
LOCAL PROTECTION PROJECTS AND HARBOR IMPROVEMENTS, SUB-REGION F

Name of Improvement	Location City or County	Stream	Year Completed	Drainage Area At Site (Sq. Mi.)	Length of Improved Channel (feet)	Improved Channel Capacity (CFS)	Bottom Width of Improved Channel
<u>ALLEGHENY RIVER BASIN</u>							
Portville, N.Y.	Cattaraugus Co.	Allegheny R. & Dodge Cr.	1951	863 & 47	24,240	40,800 & 8,300	-
Olean, N.Y.	Cattaraugus Co.	Allegheny R. & Olean Cr.	1952	1165 & 208	3,500	60,000 & 4,000	-
Bradford, Pa.	McKean Co.	Tunungwant Cr.	1961	138	36,168	12,000	30'
Johnsonburg, Pa.	Elk Co.	Clarion R.	1957	94	4,800	7,300	70'
Ridgway, Pa.	Elk Co.	Clarion R. & Elk Cr.	1962	242 & 64	12,372	18,000	40'
Brookville, Pa.	Jefferson Co.	Redbank Cr. & North Fork	1962	330	16,500	22,000	150'-30'
Sykesville, Pa.	Jefferson Co.	Stump Co. & Sugar Camp Run	1961	29	7,260	2,000	10'-30'
Big Run, Pa.	Jefferson Co.	Mahoning Cr.	1950	149	18,770	15,000	140'
Butler, Pa.	Butler Co.	Connoquenessing Cr.	1966	88	17,733	6,500	88'
Kittanning, Pa.	Armstrong Co.	Allegheny R.	1940	8,982	4,590	-	-
Tarentum, Pa.	Allegheny Co.	Bull Cr.	1962	50	5,130	6,100	35'-60'
Latrobe, Pa.	Westmoreland Co.	Loyalhanna Cr.	1950	218	23,400	28,000	150'
Oil City, Pa.	Venango Co.	Oil Cr.	1958	-	dike	22,500	-
Reynoldsville, Pa.	Jefferson Co.	Sandy Lick Cr.	1958	128	11,400	53,000	60'
Salamanca, N.Y.	Cattaraugus Co.	Allegheny R.	Under Constr.	1,661	Walls & Dikes	-	-
Johnstown, Pa.	Cambria Co.	Conemaugh R.	1943	699	47,771	86,500	60'-200'
Wilmore, Pa.	Cambria Co.	Little Conemaugh R.	1959	49	2,700	9,300	70'
Dubois, Pa.	Clearfield Co.	Sandy Lick Cr.	Under Constr.	86	25,000	3,800	15'-55'
<u>MONONGAHELA RIVER BASIN</u>							
Granville, Pa.	Washington Co.	Pike Run	1952	26	4,600	5,000	45'
Turtle Creek, Pa.	Allegheny Co.	Turtle Cr.	1967	147	33,200	12,300	70'
<u>OHIO RIVER MAIN STEM</u>							
Washington, Pa.	Washington Co.	Chartiers Cr.	1962	29	9,350	4,500	46'-56'
Burgettstown, Pa.	Washington Co.	Burgetts Fork	1952	18	9,900	2,000	15'-20'
Amsterdam, Ohio	Jefferson Co.	Yellow Cr.	1958	20	4,100	3,500	14'-30'
Chartiers Creek, Pa.	Allegheny & Washington Co.	Chartiers Cr.	Under Constr.	88	83,700	21,000	50'-120'
<u>GENESEE RIVER BASIN</u>							
Wellsville, N.Y.	Allegheny Co.	Genesee R. & Dyke Cr.	1959	288	15,260	12,300	100'-135'
<u>LAKE ERIE HARBORS</u>							
Erie, Pa.	Erie Co.	Lake Erie	1964-(412 Comp.)	-	-	29' depth	500'
Barclona, N.Y.	Chautauqua Co.	Lake Erie	1960	-	-	10' depth	100'
Dunkirk, N.Y.	Chautauqua Co.	Lake Erie	1951	-	-	18' depth	190'
Presque Isle, Pa. *	Erie Co.	Lake Erie	1956	-	-	-	-

* Beach Erosion Control

TABLE 11-6
DEVELOPMENT OF NAVIGATION (1980)

Lock & Dam	River Mile	Length Of Pool Miles	Upper Pool Elev.	Lift, Feet	Crest Of Dam	Number of Lock Chambers	Size of Lock Chambers	Placed In Operation
ALLEGHENY RIVER								
2	6.7	7.8	721.0	11.0	Fixed	1	56'x360'	Oct 1934
3	14.5	9.7	734.5	13.5	Fixed	1	56'x360'	Oct 1934
4	24.2	6.2	745.0	10.5	Fixed	1	56'x360'	Sep 1927
5	30.4	5.9	756.8	11.8	Fixed	1	56'x360'	Oct 1927
6	36.3	9.4	769.0	12.2	Fixed	1	56'x360'	Oct 1928
7	45.7	6.9	782.1	13.1	Fixed	1	56'x360'	Nov 1930
8	52.6	9.6	800.0	17.9	Fixed	1	56'x360'	May 1931
9	62.2	9.8	822.2	22.2	Fixed	1	56'x360'	Oct 1938
MONONGAHELA RIVER								
2	11.2	12.6	718.7	8.7	Fixed	2	110'x720' 56'x360'	Aug 1905 <u>a/</u>
3	23.8	17.7	726.9	8.2	Fixed	2	56'x720'	May 1907
4	41.5	19.7	743.5	16.6	Gated	2	56'x360' <u>b/</u> 56'x720'	Aug 1932 <u>c/</u>
Maxwell	61.2	21.0	763.0	19.5	Gated	2	84'x720'	Oct 1965
Grays Landing <u>g/</u>	82.2	8.6	778.0	15.0	Gated	1	84'x720'	1975
Point Marion <u>h/</u>	90.8	11.2	797.0	19.0	Gated	1	84'x600'	1975 <u>d/</u>
Morgantown	102.0	6.0	814.0	17.0	Gated	1	84'x600'	Jul 1950
Hildebrand	108.0	7.4	835.0	21.0	Gated	1	84'x600'	Mar 1960
Opekiska	115.4	13.3	857.0	22.0	Gated	1	84'x600'	Jun 1967
OHIO RIVER								
Emsworth	6.2 <u>e/</u>	6.2 <u>f/</u>	710.0	18.0	Gated	2	110'x720' 110'x1200'	Sep 1921
Dashields	13.3	7.1	692.0	10.0	Fixed	2	110'x600' 56'x360'	Aug 1929
Montgomery	31.7	18.4	682.0	17.5	Gated	2	110'x600' 56'x360'	Jun 1936
New Cumberland	54.4	22.7	664.5	22.6	Gated	2	110'x1200' 110'x600'	Jun 1960
Pike Island	84.2	29.8	644.0	21.0	Gated	2	110'x1200' 110'x600'	Sep 1965
Hannibal	126.4	42.2	623.0	21.0	Gated	2	110'x1200' 110'x600'	1972

a/ Locks reconstructed 1949-1953.

b/ New locks, 110'x720' & 84'x720', under construction.

c/ Dam reconstructed 1964-1967.

d/ Movable crest constructed on dam in 1959.

e/ Main channel dam. Back channel dam is at Mile 6.8.

f/ Pool also extends 11.2 miles and 6.7 miles up the Monongahela and Allegheny Rivers, respectively.

g/ Will replace existing Lock and Dam No. 7.

h/ Will replace existing Lock No. 8.

TABLE 11-7
UPSTREAM WATERSHED PROJECTS,
COMPLETED OR AUTHORIZED FOR INSTALLATION
SUMMARY OF PERTINENT DATA

FIGURE 11-17 MAP REFERENCE NUMBER	NAME OF WATERSHED	STATUS	TOTAL DRAINAGE AREA (SQ. MI.)	DRAINAGE AREA REGULATED (SQ. MI.)	NUMBER OF STRUCTURES		STORAGE VOLUME BY PURPOSE (ACRE FEET)					
					FLOOD RETENTION	MULTI- PURPOSE	FLOOD				WATER SUPPLY	OTHER*
							WATER	RECREATION	WATER	M & I		
ALLEGHENY RIVER BASIN												
3	Conewango Creek, N. Y.	Authorized	297	103	16	4	14,912	5,974	-	2,692		
5	Ischua Creek, N. Y.	Authorized	117	44	5	3	7,557	972	-	952		
18	Oil Creek, Pa.	Authorized	174	72	6	-	10,499	-	-	491		
2	Mill Run, Pa.	Completed	12	9	2	1	2,871	-	-	3,920		
19	Sandy Creek, Pa.	Authorized	66	59	1	1	5,349	-	-	20,008		
4	Saul-Mathay, Pa.	Completed	6	3	2	-	585	-	-	29		
MONONGAHELA RIVER BASIN												
14	Polk Creek, W. Va.	Authorized	11	7	8	-	1,528	-	-	253		
18	Upper Deckers Creek, W. Va.	Authorized	31	15	5	-	1,651	-	-	389		
4	Salem Fork - Ten Mile Cr., W. Va.	Completed	8	3	8	-	496	-	-	181		
1	Little Youghiogheny River, Md. **	Authorized	41	14	5	1	2,458	1,072	253	216		
7	Dunlap Creek, Pa.	Authorized	17	9	3	1	1,227	-	-	931		
BEAVER RIVER BASIN & OHIO MAIN STEM												
12	Little Shenango, Pa.	Authorized	114	61	4	3	7,246	2,505	-	252		
9	Harmon Creek, Pa.	Authorized	38	20	13	1	3,127	-	300	1,213		
69	Upper Buffalo Creek, W. Va.	Authorized	72	38	11	1	5,906	208	-	1,429		
76	Wheeling Creek, W. Va.	Authorized	299	201	6	1	31,421	859	-	3,590		
5	Upper Grave Creek, W. Va.	Completed	8	2	6	1	389	-	77	34		
SUSQUEHANNA RIVER BASIN												
3	North Fork Cownesque River, Pa.	Completed	12	3	1	-	626	-	-	-	41	

* Includes Sedimentation, Irrigation and Fish and Wildlife.

** Sub-region B.

Other Water Resources Programs. The U.S. Department of Agriculture's Farmers Home Administration has received 157 applications for water and sewer comprehensive planning grants from 25 counties totaling about 437,000 dollars. In addition, applications have been received for loans and grants for improving, enlarging, or constructing sewer systems, waste treatment plants, or storm drains from 85 communities, associations, public service districts, and towns. Total estimated costs exceed 56,344,000 dollars.

Water Resources Development - Non-Federal

State Projects

The Commonwealth of Pennsylvania has built 12 reservoir projects primarily for recreation. Two of the projects also include flood control and one of them low flow augmentation as additional purposes. Data on these state projects are shown in Table 11-8. The Commonwealth has also constructed 24 local flood protection projects of various types in all of the major river basins within the sub-region. (See Table 11-9).

Power Companies

The New York State Electric and Gas Company has a dam on Two Lick Creek to furnish water supply for a power plant. The Pennsylvania Electric Power Company has the Piney Hydro-Electric Project in Clarion County, Pennsylvania, which also provides recreation opportunities. Pertinent data for these projects, along with other private and municipal developments, are shown in Table 11-8.

Municipal

Table 11-10 presents an inventory of water supply sources for cities exceeding 5,000 population in the sub-region.

TABLE 11-8
NON-FEDERAL RESERVOIR PROJECTS

Project	Purposes	Area of Benefit
<u>COMMONWEALTH OF PENNSYLVANIA</u>		
Pymatuning Dam	Flood Control, Low Flow, Recreation	<u>Flood Control & Low Flow</u> in conjunction with Shenango Reservoir. <u>Recreation</u> , Western Pennsyl- vania, Southwestern New York, & Northeastern Ohio.
Lyman River Dam	Recreation	Potter County
Ole Bull Dam	Recreation	Potter County
Sandy Creek Dam	Recreation	Mercer County
George B. Stevenson Dam	Flood Control, Recreation	<u>Flood Control</u> on First Fork Sinnemahoning <u>Recreation</u> , Cameron County
McConnell Mill Run	Recreation	Lawrence County
Yellow Creek Dam	Recreation	Western Pennsylvania
Moraine Park Dam	Recreation	Western Pennsylvania
Raccoon Park Dam	Recreation	Western Pennsylvania
Keystone Lake	Recreation	Western Pennsylvania
Ryerson Station Dam	Recreation	Southwestern Pennsylvania
Galeton Fabridam	Water Supply, Recreation	Galeton, Pennsylvania
<u>MUNICIPAL AND PRIVATE (OVER 100 ACRES)</u>		
Edinboro Lake	Water Supply	Boro of Edinboro, Pa.
Bull Reservoir	Water Supply	Boro of North East, Pa.
Bradford City Water Authority Storage Reservoir	Water Supply	Bradford, Pennsylvania
Piney Dam	Hydro Electric Power, Recreation	Pennsylvania Electric Power Company, Clarion Co. Pa.
Lake Irene	Recreation	Private Development
Ridgeway Water Works Dam	Water Supply	Ridgeway, Pa.
Latrobe Reservoir	Water Supply	Latrobe, Pennsylvania
J. C. Bacon Dam	Water Supply	Ambridge, Pennsylvania
Lake Latonka	Recreation	Private Development
Unnamed Dam on Two Lick Creek	Water Supply for Power Plant	New York State Electric and Gas Company
Beaver Run Reservoir	Water Supply	Vandergrift, Pennsylvania
Canadohta Lake	Recreation	Crawford County

TABLE 11-9
NON-FEDERAL LOCAL PROTECTION PROJECTS
COMMONWEALTH OF PENNSYLVANIA

<u>Community</u>	<u>County</u>	<u>Stream or Streams</u>	<u>Length of Improvement (feet)</u>	<u>Type</u>	<u>Year Completed</u>
<u>OHIO RIVER BASIN</u>					
Boynnton	Somerset	Casselman River	2700	Levee	1955
Brockway	Jefferson	Big Piney Run	1100	Earth Channel	1959
Carnegie	Allegheny	Chartiers Creek	16,200	Channel Rectification	1968
		Cambells Run	400	Channel Rectification	
Confluence	Somerset	Youghiogheny River	600	Levee	1967
		Casselman River	5000	Levee	
Coudersport	Potter	Allegheny River	5600	Conc. Channel	
			3900	Earth Channel	
		Mill Creek	1440	Conc. Channel	1955
			1900	Imp. Earth Channel	
Darlington	Beaver	Little Beaver Creek	1300 Left Bank	Levee	1961
			1900 Right Bank	Levee	
Greensburg	Westmoreland	Jacks Run	5450	Imp. Earth Channel	1957
		Jacks Run	5700	Conc. Channel	
			2500	Levee	1960
Jeannette	Westmoreland	Brush Creek	15,700	Imp. Earth Channel	1954
		Brush Creek	256	Conc. Channel	
			82	Raising Exist. Wall	
			50 X 32	Stilling Basin	1957
			30	Imp. Earth Channel	
Meadville	Crawford	Mill Run	1160	Imp. Earth Channel	1966
Pittsburgh	Allegheny	Chartiers Creek	2680	Widening & Deepening	1966
Rockwood	Somerset	Coxes Creek	1550	Levee	1966
			1300	Channel Widening	
		Local Drainage	1100	Pressure Conduit	1967
		Casselman River	2500	Levee	
Smethport	McKean	Marvin Creek	1000	Widening & Improving	1963
		Potato Creek	2000	Widening & Improving	
		Marvin Creek	4000	Channel Rectification	1968
Tionesta	Forest	Council Run	310	60-inch Dia. Corr. Metal Pipe	1964
Warren	Warren	Gladerun	716	12" reinforced Concrete Slab	
			130	Earth Channel & Stilling Basin	1957
		Glade Run	700	Conc. Channel	1962
			3400	Levee	
		Indian Hollow Run	920	Conc. Channel	
			1242	Debris Basin	1967
			272	72" Dia. Conduit	
Westmiddlesex	Mercer	Hogback Run	1800	Outlet Channel	
			3800	Widening & Deepening	
Winber	Somerset	Paint Creek	4400	Channel Realignment	1965
		Seese Run	1200	Imp. Earth Channel	
			3350	Imp. Earth Channel	1960
		Paint Creek	650	Levee	
			50 X 35	Conc. Channel	1962
			653	Stilling Basin	
		Paint Creek	1460	Conc. Channel	
			2550	Imp. Earth Channel	1964
				Levee	
<u>LAKE ERIE BASIN</u>					
Wesleyville	Erie	Fourmile Creek	380	Imp. Earth Channel	1959
<u>GENESEE RIVER BASIN</u>					
Genesee	Potter	Genesee River	335	Imp. Earth Channel	1963
			310	Conc. retaining wall	
<u>SUSQUEHANNA RIVER BASIN</u>					
Emporium	Cameron	Plank Road Hollow Run	960	Concrete Channel Debris Dam & Stilling Basin	1962
Irvona	Clearfield	Clearfield Creek	9800	Levee	1964
		Witmer Run	1750	Levee	1966
Cherry Tree	Clearfield	West Branch	5000	Imp. Channel	
		Susquehanna R.	5300	Levee	1954
Philipsburg	Clearfield	Moshannon Creek	2800	Widening Deeping & Realigning Channel	1965
Philipsburg	Clearfield	Moshannon Creek	6300	Channel Realignment	Auth
Galeton	Potter	Pine Creek	3400	Levee	1959
				Channel Clearing	1962
				Excavation & Dumped Rip-Rap	

TABLE 11-10
MUNICIPAL WATER FACILITIES - CITIES EXCEEDING 5,000 POPULATION

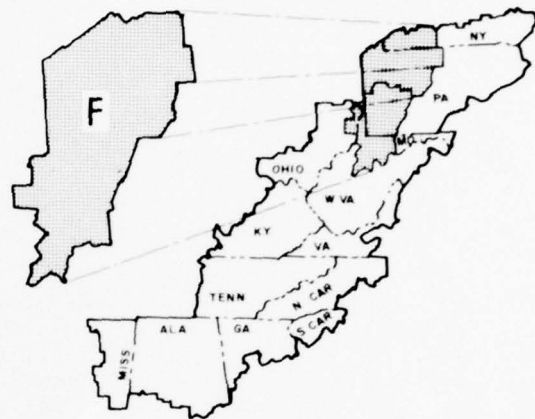
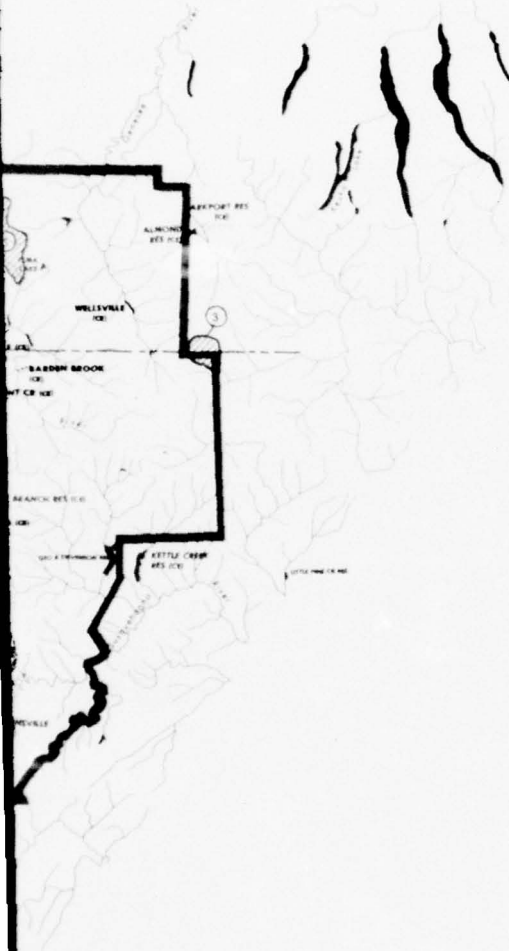
<u>City</u>	<u>Est. Pop. Served</u>	<u>Source of Supply</u>	<u>Rated Plant Cap. MGD</u>	<u>Average Plant Output MGD</u>
NEW YORK				
Allegany	4,500	3 Deep Wells	--	0.350
Dunkirk	20,115	Lake Erie	6.0	4.0
Fredonia	8,700	Canadaway Creek	1.5	1.23
Jamestown	50,000	8 Deep Wells	8.0	6.0
Olean	24,500	Olean Creek	6.0	3.7
Salamanca	10,000	Wells	4.4	1.6
Wellsville	6,000	Genesee River	1.2	1.1
Westfield	4,000	Chautauqua Creek	2.0	1.1
PENNSYLVANIA				
Aliquippa	27,500	8 Wells	4.8	4.0
Ambridge	36,150	36 Wells	5.0	3.0
Beaver	6,160	13 Wells	5.2	1.75
Beaver Falls	22,500	Beaver River	6.2	4.8
Belle Vernon	5,000	Monongahela River	1.0	0.36
Brackenridge	5,700	Allegheny River	3.0	1.5
Braddock	12,500	Monongahela River	4.0	1.9
Bradford	18,000	Wells	--	4.0
Brookville	5,150	North Fork Creek	1.5	0.7
Brownsville	8,000	Monongahela River	3.0	0.9
Butler	32,500	Connoquenessing Creek	6.0	4.0
California	5,000	Monongahela River	0.615	0.25
Cannonsburg	18,000	Chartier's Creek	2.0	1.0
Charleroi	60,000	Monongahela River	7.0	6.5
Clarion	5,300	7 Wells	1.07	0.5
Clearfield	12,000	Montgomery Run	--	1.3
Connellsville	18,000	Youghiogheny River	3.5	3.0
Corry	7,750	29 Wells	--	0.985
DuBois	15,000	Anderson Creek	--	2.0
Elizabeth	39,000	Monongahela River	4.0	5.5
Ellwood City	22,000	Slippery Rock Creek	6.4	3.0
Erie	160,000	Lake Erie	60.0	38.0
Ford City	5,500	3 Wells	2.0	0.6
Franklin	15,500	French Cr. & 6 Wells	2.6	2.25
Grove City	8,600	3 Wells	1.7	1.0
Homer City	5,500	Yellow Creek	0.62	0.375
Indiana	15,000	Two Lick Creek	2.1	1.0
Kane	6,225	12 Wells	--	0.55
Kittanning	9,000	Allegheny River	3.0	1.6
Latrobe	21,000	Loyalhanna Creek	6.0	4.75
McKeesport	70,000	Monongahela River	10.84	9.0
Masontown	5,500	Monongahela River	1.42	0.6
Meadville	18,900	7 Wells	3.0	2.5
Monaca	8,900	11 Wells	2.26	1.0

TABLE 11-10
(Cont'd)
MUNICIPAL WATER FACILITIES - CITIES EXCEEDING 5,000 POPULATION

<u>City</u>	<u>Est. Pop. Served</u>	<u>Source of Supply</u>	<u>Rated Plant Cap. MGD</u>	<u>Average Plant Output MGD</u>
PENNSYLVANIA (Cont'd)				
Monongahela	17,000	Monongahela River	3.0	1.26
New Castle	69,500	Shenango River	8.0	6.6
New Kensington	50,000	Allegheny River	9.0	5.5
Oil City	23,000	9 Wells	--	3.0
Pittsburgh	1,070,000	Allegheny and Monongahela Rivers	186.5	150.0
Punxsoutawney	9,800	Maoning Creek	2.0	0.95
Ridgway	7,000	Big Mill Run	2.6	1.3
St. Marys	10,500	Silver Creek	1.3	2.0
Sharon	59,000	Shenango River	14.0	7.5
Sharpsville	6,500	Shenango River	1.0	0.44
Tarentum	15,000	Allegheny River	2.0	1.3
Titusville	8,400	10 Wells	--	2.2
Uniontown	17,000	Youghiogheny River	4.0	2.77
Washington	42,000	Chartiers Creek	5.0	2.5
Waynesburg	8,000	Browns Creek	1.0	0.45
Wilkinsburg	210,000	Allegheny River	20.0	16.5
WEST VIRGINIA				
Clarksburg	33,800	West Fork River	9.7	2.7
Fairmont	51,190	Tygart River	8.0	6.0
Grafton	8,000	Tygart Lake	--	2.0
Morgantown	36,000	Monongahela River	6.0	4.3
Moundsville	14,300	Wells	--	0.8
New Martinsville	5,000	Wells	--	0.25
Weirton	32,800	Ohio River	2.0	1.6
Wellsburg	5,500	3 Wells	--	0.9
Weston	9,000	West Fork River	--	0.48
Wheeling	64,000	Ohio River	20.0	8.0
OHIO				
Bellaire	11,000	Ohio River	5.6	1.8
Martins Ferry	15,800	9 Wells	11.9	2.3
Shadyside	5,000	3 Wells	1.66	0.38
Steubenville	40,000	Ohio River	12.0	6.0

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VICINITY MAP

UPSTREAM WATERSHEDS

MAJOR RESERVOIRS

CHANNEL IMPROVEMENTS

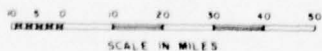
LEVEE OR WALL

LOCKS & DAMS

HARBORS

COMPLETED

EXPECTED TO BE
COMPLETED BY 1980



REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION F WATER RESOURCES DEVELOPMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-11-47

FIGURE 11-17

2

SECTION II - SOCIO-ECONOMIC STRUCTURE

4. INTRODUCTION

Planning Devices

An understanding of the social structure of Appalachia and the relationship of socio-economic development to the natural resources of the region is facilitated by dividing the region for study into a number of sub-areas designed to show the interrelationship of the principal structural elements within and between the sub-regions.

In general, the Appalachian Regional Commission has been concerned with immediate and near future problems. The data bank they have assembled on the basis of State Planning Sub-regions is the best current information available on Appalachian characteristics and problems. But the development of water resources requires estimates of future conditions as far as 100 years ahead in some cases, and nearly always 50 years into the future, according to the type of projects being investigated. To meet this need for long run estimates of future conditions, the Office of Business Economics prepared for the Office of Appalachian Studies, Corps of Engineers, population, employment and income estimates, for 1989, 2000 and 2020, based on historical trends. These projections have been presented on the basis of economic sub-regions.

To meet the need for tentative planning goals, the Office of Appalachian Studies prepared developmental benchmarks which provide a general picture of what Appalachian population and employment would be if development plans succeed and the Appalachian economy approached the characteristics of the nation. In this sense, the benchmarks provide a target, and comparisons between projects and benchmarks show the "gap" which the development programs must seek to close. The use of these benchmarks is shown in Chapter 12, Section I.

The Water Sub-regions, used as the principal divisions of the water resources survey, were drawn to reflect a grouping of the State Planning Sub-regions into the major river basins as far as this was practical. As the planning work of the Corps of Engineers is regionalized on the basis of major drainage areas, the combinations of river basins and state planning areas facilitated work assignments among the Corps Districts and the Tennessee Valley Authority.

To summarize, results of the water resources survey are displayed on the basis of ten water sub-regions, numbered "A" through "J," these sub-regions delineated on the basis of trade centers and flows in Appalachia. The projections were further broken down by water areas. The Appalachian Regional Commission used 63 State Planning Sub-regions to display the data they have gathered. Different facets of the Appalachian

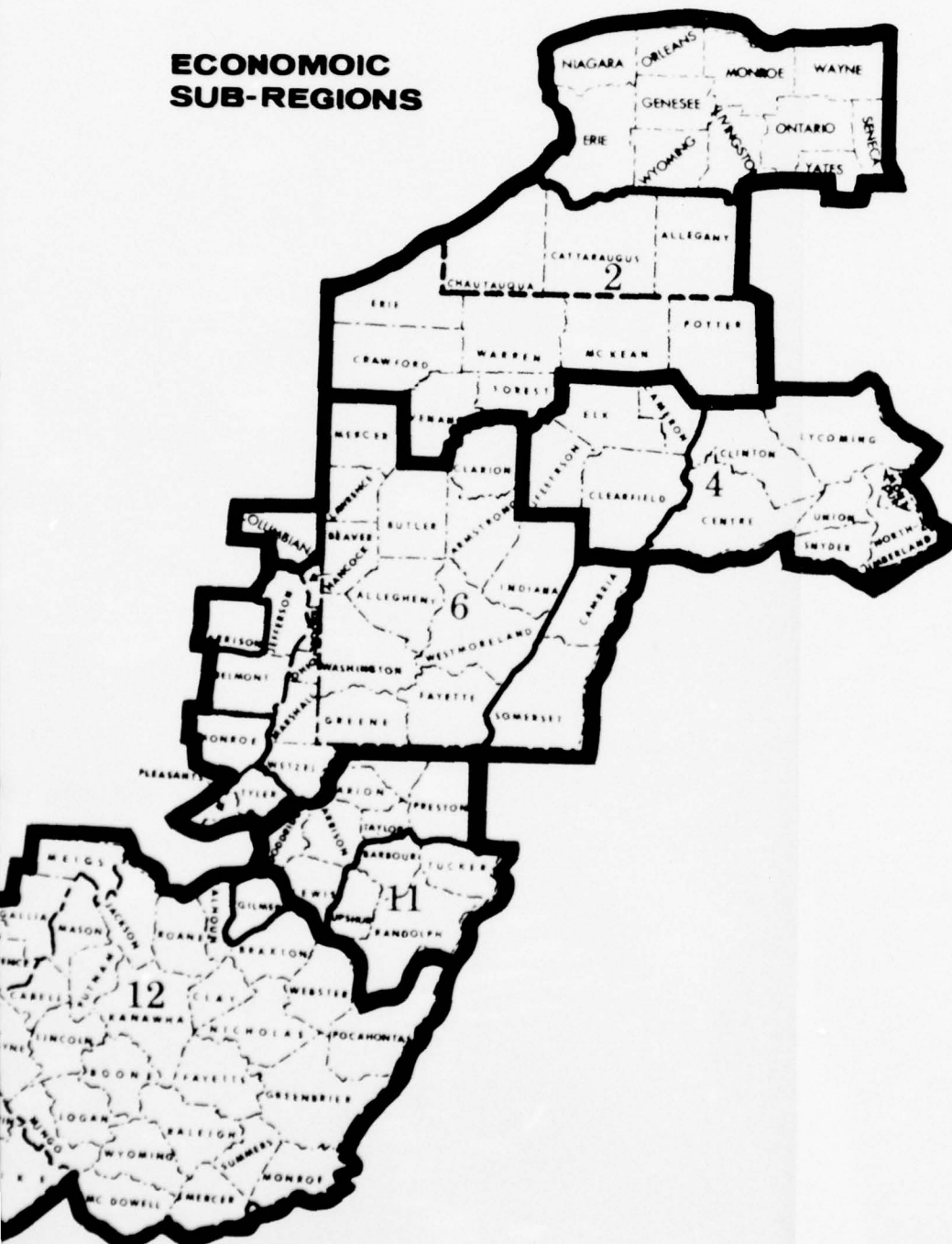
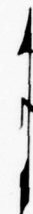
economy in relation to itself and to the United States as a whole are shown by each of these planning breakdowns.

There are eight State Planning Sub-regions or part of the sub-regions in Water Sub-region F. The State Planning Sub-regions are used in this chapter as the principal means for display of sub-regional economic and social statistics. The boundaries and identification number of each is presented in Figure 11-18, and the relation between the three State Planning Sub-regions and other delineations is shown as follows in Table 11-11.



**STATE PLANNING
SUB-REGIONS**

ING

ECONOMOIC SUB-REGIONS



LEGEND

-  APPALACHIAN REGIONAL BOUNDARY
-  WATER SUB-REGION F BOUNDARY

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION F

PLANNING AREAS

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-11-51

FIGURE 11-18

TABLE 11-11
RELATIONSHIP BETWEEN STATE PLANNING SUB-REGIONS, WATER
AREAS, AND GROWTH CENTERS

<u>State Planning Sub-region</u>	<u>Location</u>		<u>Economic Sub- regions and Growth Centers</u>
	<u>Name</u>	<u>Counties</u>	
1. (Partly in F-1)	Southwestern New York	Allegany Cattaraugus, Chautauqua	In OBE 2; New York's Southern Tier, Lake Erie Area
4. (Wholly in F-1)	Northwestern, Pa.	Erie, Crawford, Mercer, Venango, Lawrence, Warren, Forest, Clarion	In OBE 2 and 6; New Castle, Sharon, Farrell, Meadville, Lake Erie Area
6. (Wholly F-1)	North Central, Pa.	McKean, Potter, Elk, Cameron, Jefferson, Clearfield	In OBE 2 and 4; Bradford-Olean Clearfield-Dubois
5. (Wholly in F-2)	Southwestern, Pa.	Beaver, Washington, Green, Fayette, Westmoreland, Indiana Armstrong, Butler, Allegheny	In OBE 6; Greater Pittsburgh Area
11. (Partly in F-3)	Tuscarawas, River Valley Ohio	Jefferson	In OBE 6; Wheeling-Steubenville
12. (Partly in F-3)	Upper Ohio Valley, Ohio	Belmont	In OBE 6; Wheeling-Steubenville
17. (Wholly in F-3)	Northern Panhandle, W. Va.	Hancock, Brooke, Ohio, Marshall, Wetzel	In OBE 6; Wheeling-Steubenville
18. (Wholly in F-3)	Upper Monongahela River Valley, W. Va.	Monongalia, Marion, Preston, Harrison, Doddridge, Lewis, Gilmer, Taylor	In OBE 11 and 12; Clarksburg-Morgantown-Fairmont

Economic Characteristics

Economic Sub-regions 2, 4, 6, and 11 fall in whole or in part in Water Sub-region F. These economic sub-regions have been drawn around the sub-region's principal growth centers. The Pittsburgh area is the economic center of Economic Sub-region 6, which also contains the Wheeling-Steubenville area. Economic Sub-region 11 has three growth points - Clarksburg, Morgantown and Fairmont, West Virginia. For Economic Sub-region 4, Williamsport, Pennsylvania, is the principal urban center. But Water Sub-region F only contains a part of this economic sub-region. Within the water sub-region the Clearfield-DuBois area is considered the focal point of growth. The industrialized rim around southern Lake Erie is the principal economic feature of Economic Sub-region 2. There are, however, several small inland growth centers.

Although Sub-region F is one of the most strategically located, in the Appalachian region, from this viewpoint of potential economic development it has today some of the most severe economic problems. Many of these problems are related to the sub-region's historically heavy employment dependence on the steel and coal industries. There has been a steady decline in the total salaries available from these employment sources. Accordingly, Pittsburgh has been one of the least "service oriented" of the large cities of the United States and will probably remain sensitive to total salary availability. Encouragingly, growth rates comparable to the nation are now being experienced for trade, government, and the transportation equipment industry; while mining, construction, stoneclay and glass, fabricated metals and machinery, and primary metals are indicating an improved, but still below the national rate, growth factor.

The rapid development in the 19th century of the mineral resources of the area without corresponding development of other sectors of the economy and without adequate consideration of the efficiency of the settlement pattern has been at the center of the region's problems. The rugged nature of the topography for large portions of the sub-region led to placement of rail and roadways in the narrow valleys. This ultimately led to long lines of low quality housing ties. Primary (Agriculture, Forestry, and Mining) employment in relation to population has been higher here than in any other large metropolitan area of the United States.*/

Some of the general socio-economic characteristics of Sub-region F should be considered as a basis for formulating strategies for economically effective resource development. In Water Sub-region F, the

*/ Region in Transition, Economic Study of the Pittsburgh Region. Pittsburgh Regional Planning Commission, 1963.

major metropolitan areas have been growing slower than comparable areas in the nation; consequently, from much of this area there has been a large outflow of population. For example, Pittsburgh's low population growth is almost unique among the metropolitan areas of the United States. In jobs as well as in people, Pittsburgh has lagged behind other metropolitan areas. The same is more or less true of the other large cities of this sub-region. The smaller centers of urban population have often shown adequate growth patterns.

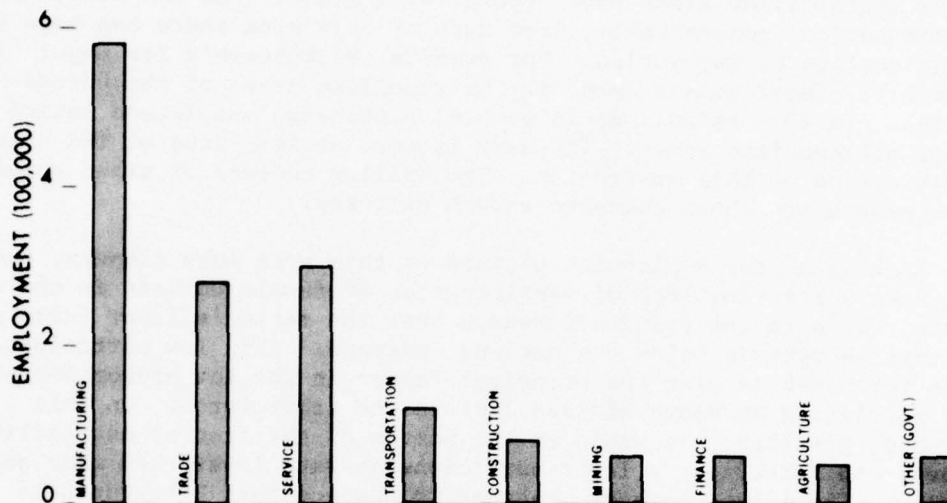
Looking at the employment picture of this area more closely, there has been a striking lack of participation of female workers in the labor force. This is the principal reason that the region's labor force participation rate is below the national average. This low participation rate for women is also the principal factor in the low proportion of the population 14 years old and over in the labor force. In this respect, Pittsburgh is again at the bottom of the list of metropolitan areas, and indeed has a labor participation rate lower than many small cities. There are, however, reasons to suspect that Pittsburgh is moving slowly toward the national rate.*/

Along with this low participation rate much of this sub-region has had a high unemployment rate. The Pittsburgh Regional Planning Association found that ever since the Korean War boom "... Pittsburgh's unemployment rate has been higher than the nation's, and among the larger metropolitan areas, only Detroit has experienced as high rates of unemployment.**/ Wage rates have also been mixed, with some very high wages but many lower than would be expected in a city of such size. Slow growth, low labor force participation, and a mixed wage structure are not only characteristics of Pittsburgh, but are found to a degree in all of the large urban centers of Sub-region F. These structural features stem from a long history of resource exploitation under the guidance of a few business leaders. Students of the area have noted the minor role that small business plays in the large cities which dominate the economy of this area.

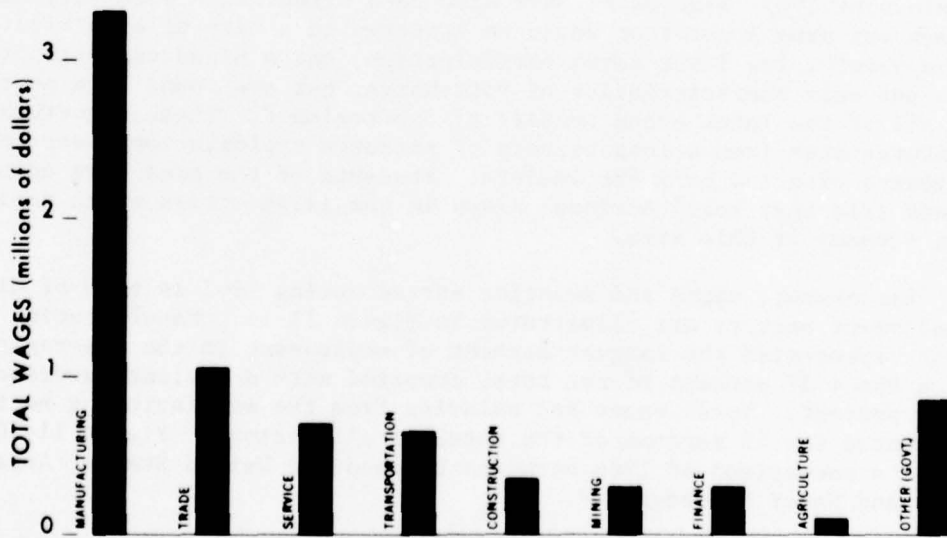
Employment, wages and salaries earned during 1962 in each of nine employment sectors are illustrated in Figure 11-19. Manufacturing in 1962 represented the largest segment of employment in the sub-region with about 37 percent of the total compared with a national average of 27.5 percent. Total wages and salaries from the manufacturing sector accounted for 45 percent of the total of all sectors. Figure 11-20 shows a comparison of 1966 earnings between the United States, Appalachia and Water Sub-region F.

*/ Provisional Employment and Population Forecasts, Southwestern Pennsylvania Regional Commission, 1968.

**/ Region in Transition, Pittsburgh Regional Planning Commission, 1963.



**SUB-REGION EMPLOYMENT
BY
EMPLOYMENT SECTOR
1962**



**WAGES AND SALARIES
BY
EMPLOYMENT SECTOR
1962**

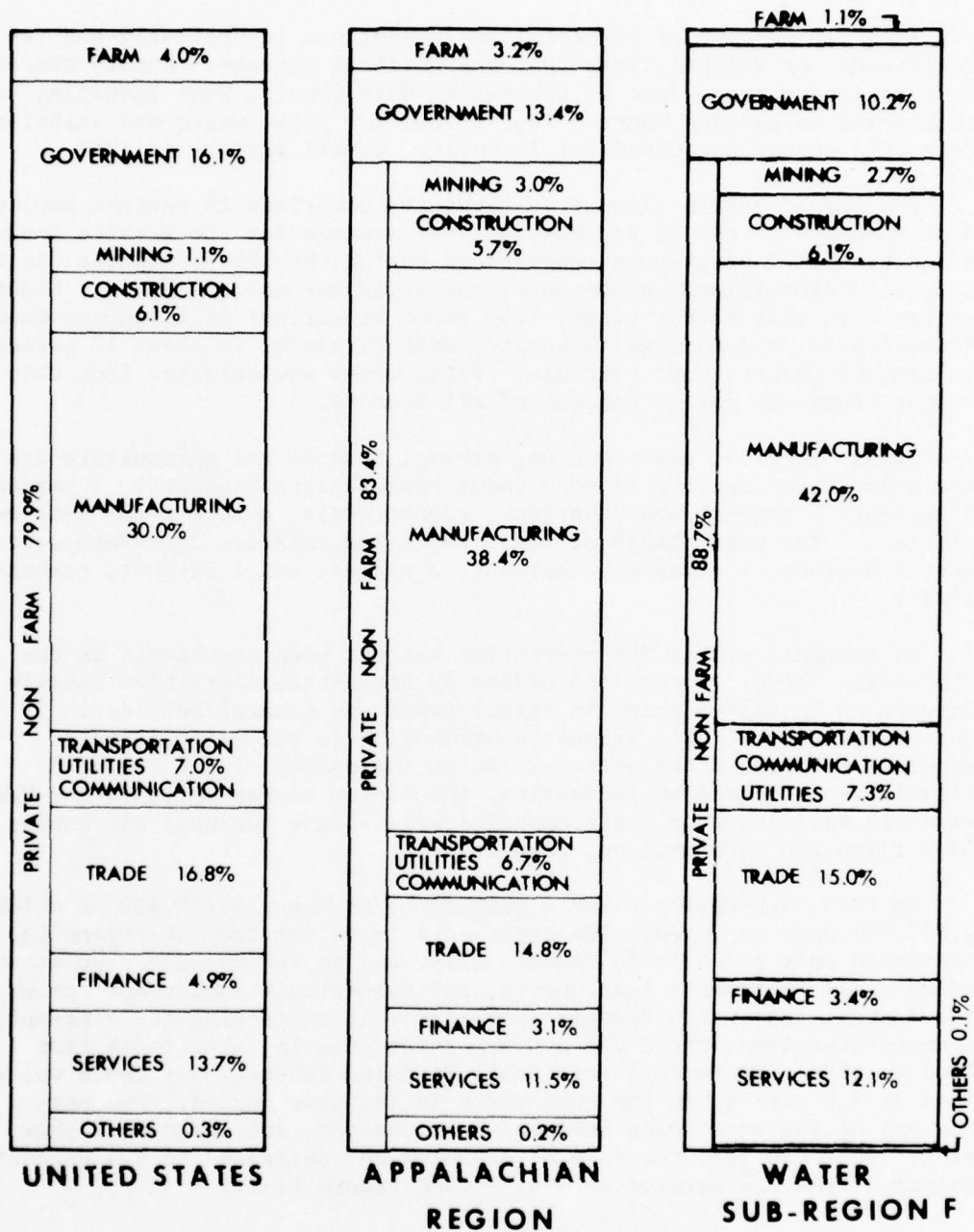


FIGURE 11-20

SOURCES OF INCOME

1966

About 18 percent of the total employment was in wholesale and retail trade, or slightly less than the national average. County averages in this sector range from 24 percent in Ohio County, West Virginia, to 12 percent in Hancock County, West Virginia. Total wages and salaries from this sector accounted for 14 percent of all sectors in 1962.

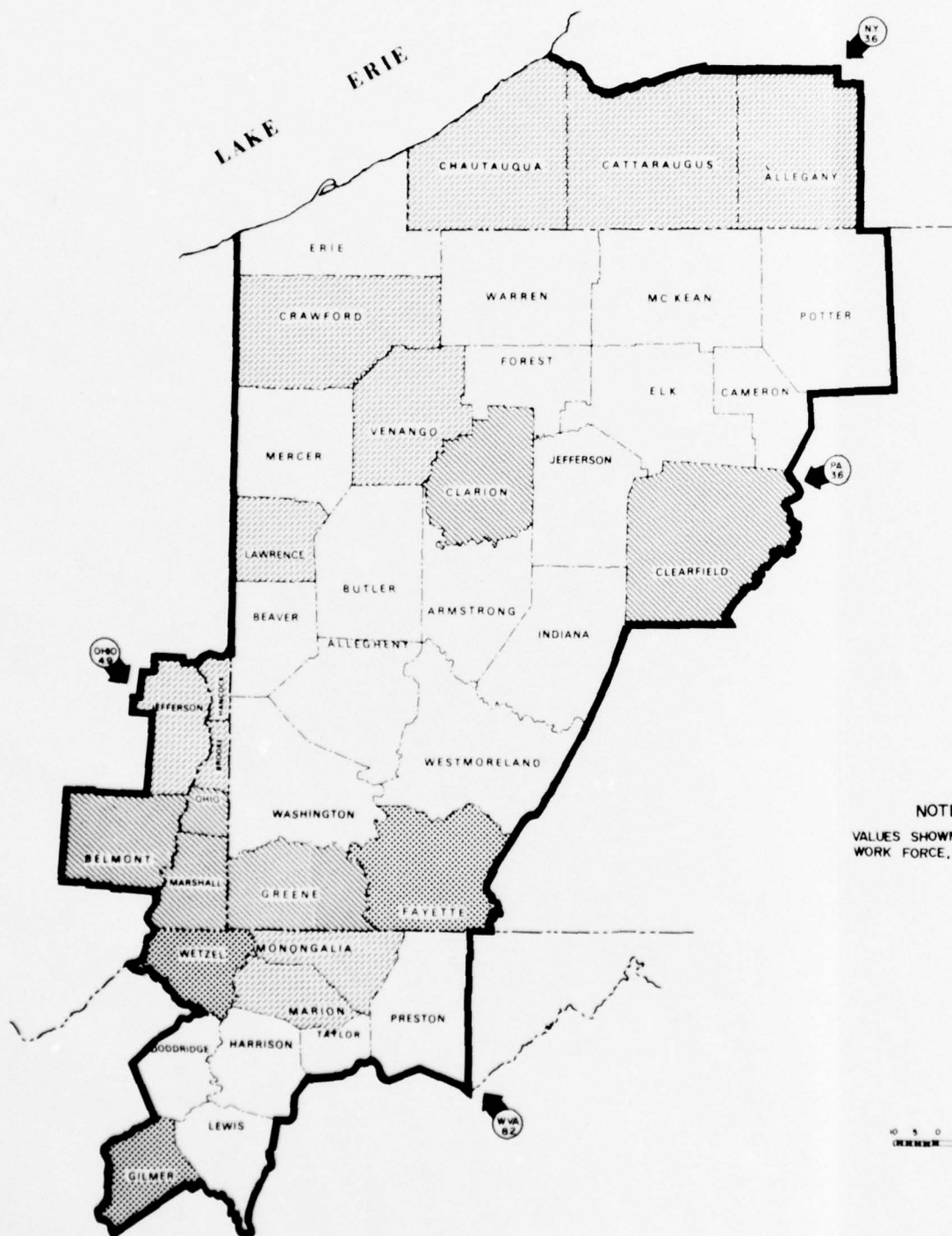
The second ranking industry, services, comprises 19 percent employment compared to the 21 percent national average for the service industry. A substantial increase was experienced during the 1950-60 decade due to increased professional employment, mainly in the medical field. County averages in this sector ranged from about 31 percent in Allegheny County, Pennsylvania, and Monongalia County, West Virginia, to about 12 percent in Hancock County, West Virginia. Total wages and salaries from this sector accounted for 10 percent of all sectors.

Transportation, construction, mining, finance and agriculture are the major other sources of employment representing 8 percent, 5 percent, 3 percent, 3 percent and 3 percent, respectively, of the total 1962 employment. The percentages of total wages and salaries for these sectors were 9 percent, 4 percent, 3 percent, 3 percent and 1 percent, respectively.

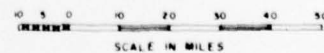
An economic sector for recreation has not been considered in the discussion above. Income stimulated by recreation activities usually appears as increased sales in retail trade and general services. Therefore, recreation's largest contribution is the stimulation it provides to these other sectors. As an indication of the degree of stimulation afforded by recreation, the States of Pennsylvania and West Virginia estimate that their annual tourist-trade business approaches \$3 billion and \$300 million, respectively.

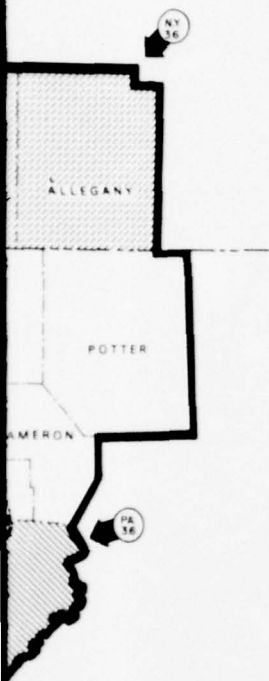
In 1965, Sub-region F had a work force of about 1,750,300 of which 1,674,800 were employed. The total work force for the sub-region has increased only slightly in recent years, and in the heavily populated urban areas there have been uneven, but significant employment losses. For Pennsylvania State Planning Sub-region 5, containing the Pittsburgh Metropolitan Area, there was a 0.4 percent loss in labor force from 1962 to 1965. In Pennsylvania State Planning Sub-region 6 there was a loss of 3.8 percent in the work force in the same period. The percentage of the work force employed has, however, increased each year since 1962. In 1965 the rate of unemployment decreased to 4.4 percent compared from 7.2 percent in 1962. (See Figure 11-21).

More women are seeking and obtaining employment than formerly. As the labor force has not grown greatly this has tended to create some imbalance and the displacement of men. For example, in New York State Planning Sub-region 1, there was a 7.1 percent decrease in male employment from 1950 to 1960, while female employment increased by 15.6 percent.



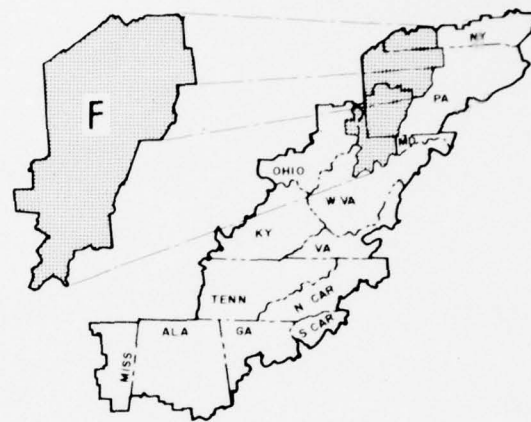
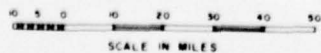
NOTE
VALUES SHOWN ARE FOR CIVILIAN
WORK FORCE, 1966










NOTE

VALUES SHOWN ARE FOR CIVILIAN
WORK FORCE, 1966.



VICINITY MAP

LEGEND

-  COUNTIES HAVING LESS THAN 30%
-  COUNTIES HAVING 30%-4.9%
-  COUNTIES HAVING 5.0%-6.9%
-  COUNTIES HAVING 7.0% & OVER
-  PERCENT OF UNEMPLOYMENT FOR
APPALACHIAN PORTION OF STATE SHOWN.

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION F

UNEMPLOYMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-11-59

FIGURE 11-21

Many of the present skills were developed in the mining and heavy metals industries and are being replaced by mechanization. Coincidentally, it is this intensive mechanization and resultant increased productivity that is helping to keep bituminous coal competitive as a useful energy source. The strong unionization of certain trades slows changes in some instances, making it difficult to overcome labor skill obsolescence. Many of the heavily populated parts of the sub-region are in mountainous areas which makes long distance commuting difficult. For this reason it is difficult to reorganize industries and to gather skilled work force needed for new industries.

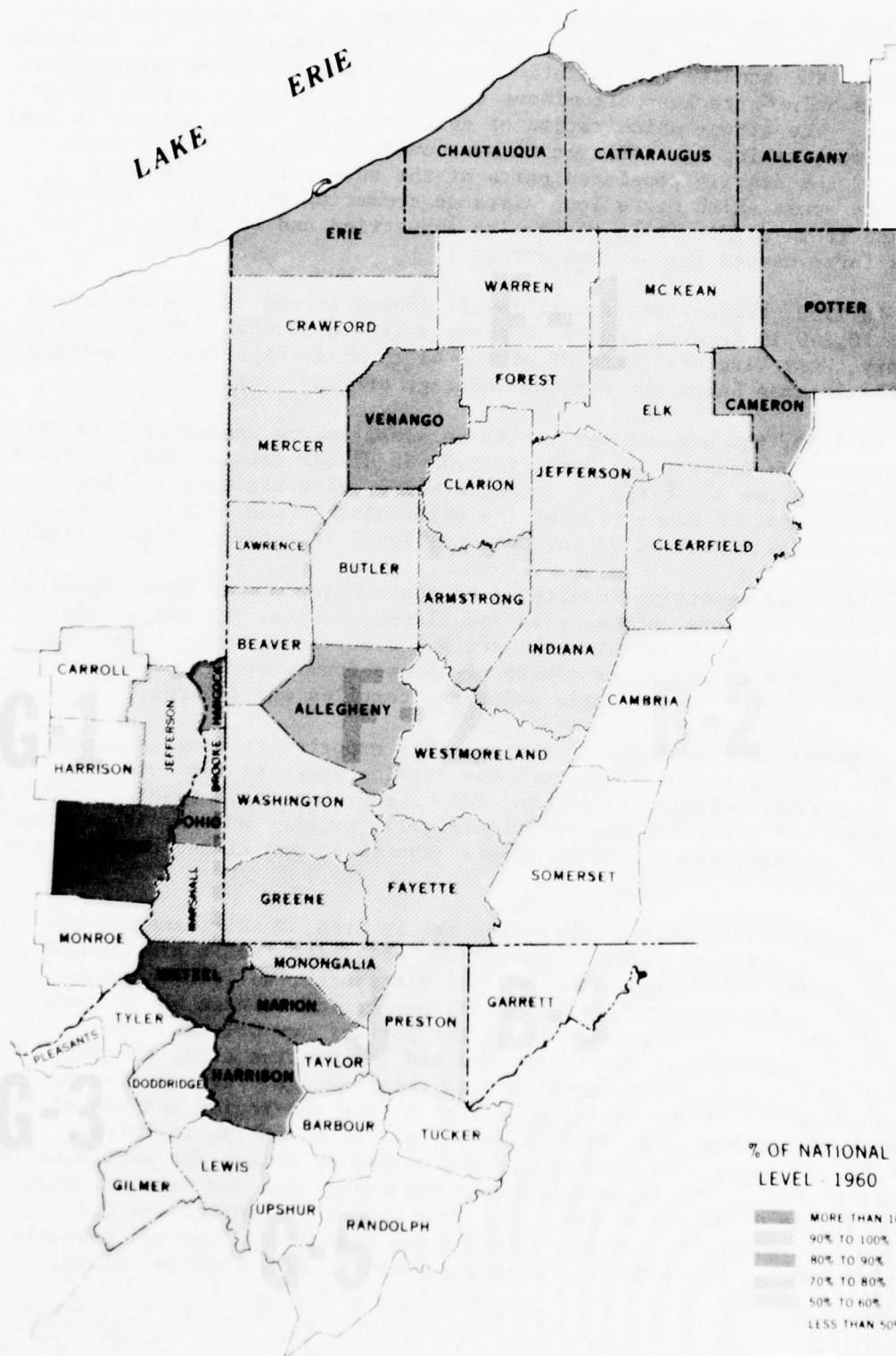
In 1960, the average annual family income in the sub-region ranged from \$8,240 in Cameron County, Pennsylvania, to \$3,660 in Gilmer County, West Virginia, with 38 of the 41 counties experiencing average family incomes below the national average of 7,350 dollars.

In 1960, the average per capita personal income ranged from \$2,087 in Chautauqua County, New York, to \$902 in Gilmer County, West Virginia, with levels for 37 of the 41 counties being below the national level of 1,850 dollars. A comparison of the per capita income throughout the sub-region as a percent of the national level is shown in Figure 11-22.

The major exporting industries of the sub-region are coal, chemicals and allied products, stone, clay and glass products, ferrous metals, fabricated metal products, machinery and electrical energy. Ferrous metals have been the major source of income from exports. The major domestic imports to this area are food, textiles and apparel.

Manufactured products of the area are exported to many countries of the world principally through the leading ports of New York City, Philadelphia, Buffalo, Baltimore, and Lake Erie ports. Leading products exported are machinery (except electrical), primary metals, transportation equipment, electrical machinery, chemicals and allied products and glass.

Ports located in the sub-region are at Erie, Dunkirk and Barcelona. The ports of Buffalo, Tonawanda, and Niagara Falls are located north of the sub-region. The port of Pittsburgh, while not a sea-going facility, handles a significant commercial tonnage which finds itself in the export trade through the port of New Orleans. Exporting industries in Water Area F-2 and in counties along the Ohio River in Water Area F-3 contribute to this tonnage. Erie Harbor in Water area F-1 is the principal harbor in the sub-region and one of twelve cities with port facilities on Lake Erie. Ships that travel the St. Lawrence Seaway can enter the harbor at Erie. The port usually operates from April through November depending upon the weather condition in the Great Lakes area. The main products exported are oil, oil products, lumber, machinery and steel products. Imported products include pig iron, woodpulp, newsprint, rubber, tin, tapioca, flour,



PER CAPITA INCOME
FIGURE 11-22

road salt and plywood. Direct rail and truck loading to the hinterland are provided. Water Area F-1 is fortunate in its capability to have its products transported to every corner of the world through the port of Erie. Water Areas F-2 and F-3 enjoy the same capability via the inland waterway system through the port of New Orleans.

The value of exported products is of significance to the economy of the sub-region, and offers potential growth industries the opportunity to build upon the present export base. Allegany County in Water Area F-2 exported products valued at \$153 million, and Erie County in Water Area F-1 exported products valued at \$72 million in 1965.

Capital Availability

The sub-region has adequate sources of funds for industrial and commercial development. Pittsburgh is one of the nation's largest banking centers. This center and others of smaller stature in the sub-region form a highly agglomerated banking structure by which the leading private financial institutions are capable of offering sufficient capital to business enterprises and various agencies engaged in industrial promotion and general economic betterment. The sub-region's established financial institutions, in addition to the various public or semi-public lending agencies and programs which supplement the business lending activities of the commercial banks (such as the state-encouraged industrial development organizations and the Small Business Investment Corporations established by a 1958 Act of Congress), are sufficient for the sub-region's future growth. The sub-region's financial situation is shown in Figure 11-23.

The local industrial development corporations have provided sources of capital for many new undertakings which might have found it difficult to obtain financing.

The states and the municipalities have had limited financial resources. For the Appalachian Region, this difficulty has to some degree been removed by the programs started and/or enlarged under the Appalachian Regional Development Act of 1965.

Local Attitudes

Attitudes toward economic growth vary considerably throughout Sub-region F. Efforts are now being made to educate the public to the community requirements essential if new industry is to be attracted.

The Appalachian program has served to alert the states to the potentials the region holds for economic growth. The states' investment plans are directed to those economic efforts and toward those sub-regions where the process of economic development can be accelerated. As the

program of the Appalachian Regional Commission has advanced, there has developed a much better understanding of the needs of the sub-region and of the necessity to improve the overall condition of the sub-region. Consequently, considerable unity of purpose is developing among Federal, state and local planners. Most regional and county planning commissions have studied present and future developmental possibilities, and have determined their assets and problem areas.

Students of the Pittsburgh area find that the industrial and financial leaders are showing renewed interest in the sub-regional economy and are setting new community goals. Because of its strategic location, many major headquarter corporations are currently locating imaginative new industrial research and development centers in the sub-region. There appears also to be a revival of interest by the major primary metals producers to plan for extensive rehabilitation of existing steel producing plants and for construction of new and modern facilities. A measure of these activities are now evident and are considered part of the existing socio-economic structure.

Although new entrants into the major manufacturing complexes, particularly at Erie and Pittsburgh, have been slow in deciding that the industrial and institutional environment would be conducive to a favorable return on their investments, it would appear particularly from planning which is currently in evidence in the Pittsburgh and Erie and associated urban complex that new and accelerated investment opportunities are being actively formulated to not only bolster the previously sagging trend in the area's economic development, but also to augment its future possibilities.

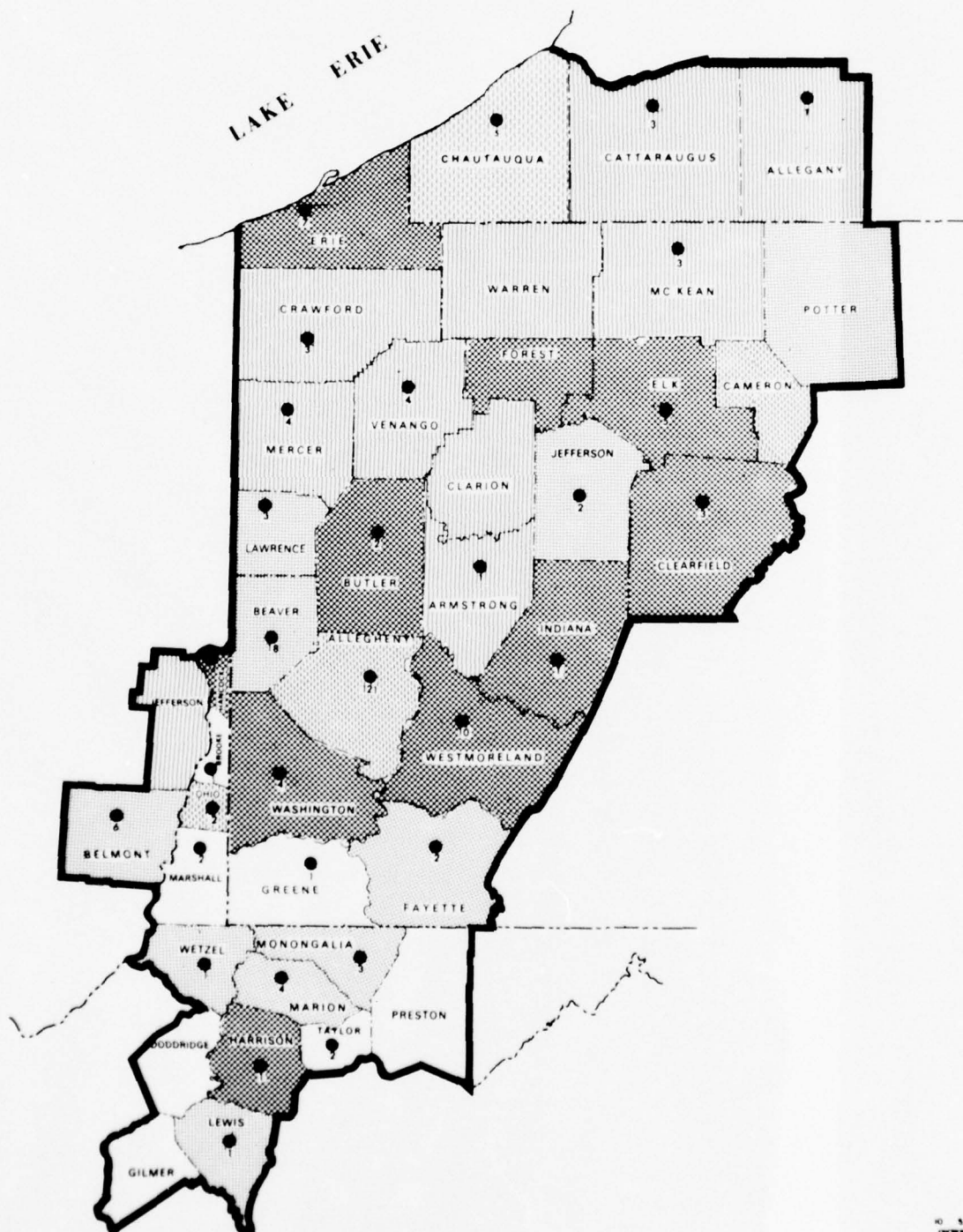
An extensive program for attraction of new enterprises to the sub-region is being jointly carried on by the states, by the public utilities systems, and by the efforts of regional industrial development corporations, all of whom appear currently to be willing to develop sources of local capital to support new growth. The program is gathering momentum.

5. WATER AREAS

The three water areas of Water Sub-region F are divided into 8 state planning sub-regions, or parts of sub-regions. The boundaries and identification number of each is presented in Figure 11-18, and the relation between the state planning sub-regions and the other geographical delineations is shown in Table 11-11. The state planning sub-regions represent the basic planning units for the Appalachian Water Resource Survey.

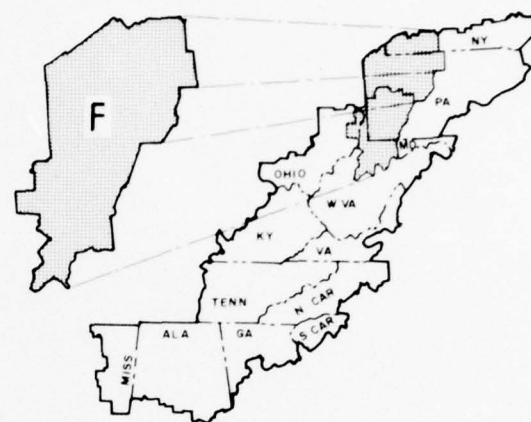
Water Area F-1

Water Area F-1 has 26.4 percent of the sub-region's total employment, 28.4 percent of the sub-region's total manufacturing employment



NOTE
PER-CAPITA DEPOSITS
AS OF 30 JUNE 1966

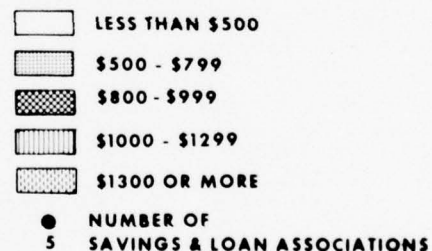
0 5 10 20 30 40
MILES
SCALE IN MILES



VICINITY MAP

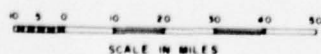
LEGEND

BANK DEPOSITS, PER-CAPITA
BY COUNTY:



NOTE

PER-CAPITA DEPOSITS
AS OF 30 JUNE 1966



REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION F

FINANCIAL SITUATION

OFFICE OF APPALACHIAN STUDIES JUNE 1968

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FIGURE 11-23

2

and 24.75 percent of the sub-region's total commercial employment. It is the largest of the water areas in the land area and the least developed with respect to land use. With the exception of Erie and Chautauqua Counties which border on Lake Erie, water transportation is not available in this water area. The predominant manufacturing industry is the machinery sector with fabricated metals, stone, clay, and glass, together equalling that of the machinery sector. For the seventeen counties of this water area more than half of the total employment is found in Erie, Chautauqua, Lawrence and Mercer Counties, and even a larger concentration of the total manufacturing employment.

State Planning Sub-region 1

New York State Planning Sub-region 1 contains six counties, three of which are in Water Sub-region F and the remainder in Water Sub-region B. In this section of the report only the three counties located in Sub-region F are included, unless otherwise noted. Allegany, Cattaraugus, and Chautauqua Counties within New York State Planning Sub-region 1 account for about six percent of the water sub-region's total population. The state planning sub-region is slightly more rural and more agricultural than the water sub-region overall. See Figure 11-24.

Population increased 6.5 percent during the period 1950-1965. Concurrently, total employment increased 5.4 percent. Within the manufacturing sector, employment in food, textiles and the wood and paper industries showed modest gains. Employment during this period in the private services sector, and to some extent in the government sector, helped counterbalance losses experienced in other sectors.

In 1965, the employable labor force in this portion of State Planning Sub-region 1 numbered 108,400 persons. There were 4,800 persons unemployed, an unemployment rate of 4.4 percent.

Of 103,600 persons employed in these New York counties, 49 percent were employed in services, and 35 percent in manufacturing. Employment in machinery and miscellaneous; clay, glass and metal; and wood and paper. In terms of numbers of employees, each employment category, wholesale and retail trade, government, and personal services, accounted for about one-half of the number provided by the manufacturing sector; and the agriculture sector accounted for about one-third.

State Planning Sub-region 1 embraces growth centers that are presently more localized at the following widely dispersed primary points in contrast to more highly developed, closer knit, regional centers prevalent elsewhere in the water sub-region.

Jamestown-Warren. This primary growth center extends from Mayville along the shores of Lake Chautauqua, around Jamestown, south along Route 62 and the Conewango Creek to Warren, Pennsylvania, where the Conewango flows into the Allegheny River.

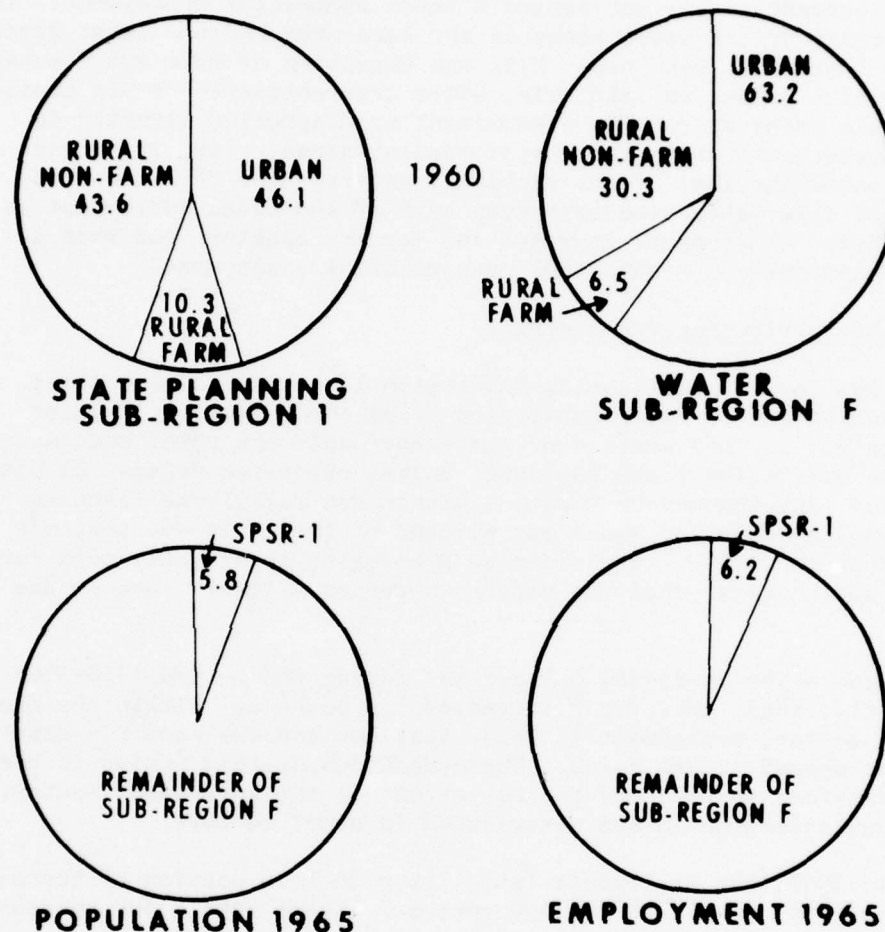


Figure 11-24 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 1 Compared to Sub-region F.

Jamestown has long been an important furniture manufacturing city. Other important manufacturers in Jamestown produce electrical appliances, ball and roller bearings, metal products, tools and voting machines. The village of Falconer, just outside of Jamestown, has several large manufacturing plants producing items such as toys, metal partitions, metal products, furniture, petroleum, wire, electrical equipment and electronic components.

There are a number of small industrial research laboratories in the growth center which conduct research in a variety of fields including

ultrasonics, ceramic fusions, X-ray diffraction, metallurgy, lubricants and industrial finishes. Most of these labs are connected with local manufacturing plants.

Chautauqua Lake is a popular resort area, attracting visitors from a wide area. The cultural activities at the Chautauqua Institution also attract many summer visitors.

A number of factors combine to give the Jamestown growth center a good potential for future economic growth. Among these are a large urban population, a strong, diversified industrial base, good transportation facilities, and ample hinterland recreational opportunities. In addition, there are many desirable industrial sites in the growth center with available rail and utility service.

Lake Erie. This incipient growth center extends along the shore of Lake Erie from Silver Creek to Ripley in New York, and in contiguous with megalopolis developments on the east to Buffalo, and on the west to Cleveland, Ohio. It is just north of the Jamestown growth center and includes the City of Dunkirk and parts of seven towns which together are forming a cohesive, continuous strip development along the Lake Erie shoreline. The hinterland of the Dunkirk-Lake Erie growth center includes the northwestern half of Chautauqua County and small parts of Erie and Cattaraugus Counties.

Dunkirk is an important industrial center specializing in the production of iron and steel and metal products. Food processing and canning of a large variety of locally grown produce are important sources of manufacturing jobs in Dunkirk and several smaller communities in the growth center. Westfield is especially noted for the production of grape juice and grape products from locally grown grapes. Silver Creek has a diversified manufacturing base including manufacturers of electrical equipment, food processing machinery, machine tools and food products.

The State University College at Fredonia has made a substantial contribution to the economy of the growth center in recent years. Its enrollment, about 2,700 is roughly double the figure five years ago. An expansion program which is currently underway is expected to result in further enrollment increases over the next five years.

Industrial research is also contributing to the economy of the growth center. Laboratories in Dunkirk, Silver Creek and Westfield conduct research in such fields as hot water and steam boilers, electrochemistry, rocket engines, automation equipment, vacuum chambers, cryogenics, electromagnetics and food processes. Some 325 scientists, engineers, technicians and supporting personnel are employed in these labs.

There are many popular water recreation sites in the growth center along Lake Erie, including Lake Erie State Park and a number of private beaches. However, in recent years pollution of the lake has reduced the attractiveness of many of these facilities.

In the hinterland, water recreation is available on Chautauqua Lake and a number of smaller lakes. A small-boat harbor at North East, Pennsylvania for small craft navigation and recreational fishing has prospects for early provision. This would also furnish a harbor of refuge between Erie and Barcelona; a similar harbor is also possible at Lake Erie State Park. Skiing has increased in importance in the hinterland in recent years, with prospects for growth in areas amenable to this resource.

In summary, several factors combine to enhance the growth potential of the Lake Erie growth center. These include a strategic location, a diversified industrial base, excellent transportation facilities and ample recreation opportunities. In addition, there are many improved and potential industrial sites in the growth center and an ample supply of industrial water is available from Lake Erie. An urban renewal project currently in the planning stage and small boat-harbor improvements in Dunkirk should improve that city's development potential.

Olean-Bradford. This well established Primary Growth Center includes the cities of Olean and Salamanca and parts of five adjacent towns in New York, and the contiguously associated Pennsylvania area involving the City of Bradford and parts of two townships. Manufacturing is a major activity contributing to the importance of this growth center. Progressive manufacturers important to the output of the area produce compressors, electronic and electric equipment, floor and wall tile and cutlery in Olean. Salamanca's major product is furniture. In Bradford, leading manufactured products include petroleum, cutlery, valves, pumps and compressors, electronic components and cigarette lighters. Total manufacturing employment in the Olean-Bradford growth center is estimated at about 10,000.

A number of major manufacturing expansions are currently planned for early implementation, or are underway. Of those completed in the last two years, the largest is the \$14 million ammonia-fertilizer complex at Olean. This complex will provide about 200 jobs when fully developed, and may stimulate significant ancillary development. It is reported that there have been at least ten major industrial expansions planned, underway or completed in the New York portion of the growth center since the beginning of 1964. These represent an investment of over \$2,000,000, and the creation of several hundred new jobs.

Wellsville. The Wellsville growth center includes the village and most of the town of Wellsville, and parts of five other adjacent towns. The growth center extends east to west along Route 17 (the

Southern Tier Expressway) from Andover, through Wellsville, to Bolivar and north from Wellsville, along the upper Genesee River, to Belmont.

Manufacturing activity is mainly concentrated in two large plants, one producing steam turbines and generators and the other, air pre-heaters. Other firms produce plastic products and metal furniture.

The basis for this growth center's development potential lies in improved transportation facilities via the new Southern Tier Expressway and highways to service several improved and potential industrial sites. The development of timber resources in the area around Wellsville furnishes an opportunity to enhance current efforts to broaden and expand the growth center's industrial base.

Hornell. The western fringe of this growth center including the town of Alfred is located in Allegany County, and extends east to include the City of Hornell and the Town of Canisteo. The total area presently supports some 25,000 persons, with a large increase experienced in the 1960-65 period.

Alfred is a higher education center of 3,500 students who are enrolled at Alfred University and the State University of Ceramics and the Agricultural and Technical Institute. Both Alfred University and the State University Agricultural and Technical Institute are currently undertaking multi-million dollar expansion programs which are expected to result in enrollment increases. The College of Ceramics maintains a research laboratory with a full-time staff of scientists and technicians doing research in ceramics, high temperature materials, solid state physics and chemistry.

In addition to being a rail center, there is considerable manufacturing in Hornell. Major firms there produce postal equipment, women's hosiery, synthetic textiles, electric transformers and housings for bearings. There are also a few small manufacturing plants in both Alfred and Canisteo. Manufacturing employment in the growth center is estimated at about 1,000 persons.

In summary, the future growth potential of the Hornell-Alfred growth center is based primarily on the institutions of higher education at Alfred, plans for rerouting the Southern Tier Expressway through the growth center and a small but diversified industrial base. In addition, there are a number of improved industrial sites in the growth center enhancing its potential for industrial development.

Gowanda. Located in the northwestern portion of Cattaraugus County on Cattaraugus Creek this area has a very high level of manufacturing employment for its population. Chemical and leather products represent the major portion of this employment and local leaders expect growth to continue in these sectors at or above the national level.

Franklinville. Located twenty miles north of Olean, New York this area is expected to share the growth of this urban area. With good railroad facilities and access to markets and a skilled labor force in machinery as a base, economic potential of this area is expected to be good. The availability of manufacturing sites purchased by the community enhances the future potential of this area.

Statistical Summary. The growth centers in New York Sub-region 1 have exhibited growth potential sufficient to merit their identification by the State of New York. Identification has been dependent upon the factors discussed above in relation to each area. Generally, the planning sub-region has interrelated and highly developed urban complexes with a growing economic base and sufficient space to permit continued development and growth. The statistical summaries support the growth potential of the planning sub-region. Data for the three counties of State Planning Sub-region 1 falling in Water Sub-region F are shown in Tables 11-12 and 11-13.

TABLE 11-12
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
NEW YORK STATE PLANNING SUB-REGION 1 ^{*/}

	<u>1950</u>	<u>1960</u>	<u>Absolute Change</u>
TOTAL ALL SECTORS	98,396	97,542	- 854
PRIMARY ACTIVITIES	14,102	8,637	-5,465
Agriculture	12,368	7,796	-4,572
Forestry & Fisheries	148	61	- 87
Mining	1,586	780	- 806
SECONDARY ACTIVITIES	39,364	39,819	455
Contract Construction	4,921	4,744	- 177
Food & Kindred Products	2,752	3,272	520
Textile Mill Products	2,812	1,099	-1,713
Apparel	572	971	399
Lumber, Wood Products, Furniture	7,705	7,415	- 290
Printing & Publishing	1,097	1,592	495
Chemicals & Allied Products	436	418	- 18
Electrical & Other Machinery	6,908	8,823	1,915
Motor Vehicles & Equipment	330	654	324
Other Transportation Equipt.	436	322	- 114
Other & Miscellaneous	11,395	10,509	- 886
TERTIARY ACTIVITIES	43,716	46,668	2,952
Transportation & Communi- cations	5,288	4,245	-1,043
Utilities & Sanitary Service	1,132	1,439	307
Wholesale Trade	2,355	2,118	- 237
Retail Trade	13,848	13,813	- 35
Finance, Ins. & Real Estate	1,893	2,547	654
Personal Services	6,648	6,071	- 577
Professional Services	9,348	13,071	3,723
Recreational Services	622	619	- 3
Public Administration	2,513	2,660	147
Armed Forces	69	85	16
NOT REPORTED	1,214	2,418	1,204

^{*/} This information is for the original State Planning Sub-region 1, containing only Allegany, Cattaraugus and Chautauqua Counties. Unless otherwise noted, all other reference to State Planning Sub-region 1 are for a six-county area (see Appendix E for boundary).

TABLE 11-13
SOCIO-ECONOMIC CHARACTERISTICS
NEW YORK STATE PLANNING SUB-REGION 1 ^{*/}
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1966		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	273,800	Number	269,542	132,324	137,218	27,787	117,396	124,359
Absolute Change 1960-1966	4,300	Percent Distribution	100.00	49.09	50.91	10.31	43.55	46.14
Percent Change 1960-1966	1.60	Percent Change 1950-1960	4.93	3.80	6.05	-45.37	39.51	2.05

DISTRIBUTION OF FAMILIES BY INCOME, 1960						
	Under \$2000	\$2000- \$2999	\$3000- \$5999	\$6000- \$9999	\$10,000 & Over	Total
Number	7,360	5,632	27,404	21,504	6,964	68,864
Percent Distribution	10.69	8.18	39.79	31.23	10.11	100.00
Percent Change 1950-1960	-53.91	-61.54	3.96	-21.26	-485.21	4.77

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960				
	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	153,166	54,369	74,804	21,953
Percent Distribution	100.00	35.50	48.84	14.33
Percent Change 1950-1960	0.62	-12.50	15.17	9.44

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960						RATE OF UNEMPLOYMENT, 1962-65	
	Total	Male		Female		1962	1965
	Employed	Unem- ployed	Employed	Unem- ployed	Employed	Unem- ployed	
Number	97,457	6,652	66,424	4,386	31,033	2,266	7.2
Percent Distribution	93.61	6.39	93.81	6.19	93.19	6.81	6.8
Percent Change 1950-1960	-0.88	27.00	-7.09	14.82	15.64	59.80	5.6
							4.4

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960							PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT		
	Total		Male		Female		1965 Number	Chng. 1962-65 No.	%
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force			
Number	104,194	87,824	70,895	21,982	33,299	65,842	Tot. Work Force	108.4	2.0
Percent Distribution	54.26	45.74	76.33	23.67	66.41	33.59	Tot. Employment	103.6	4.8
Percent Change 1950-1960	0.54	-2.52	-5.94	10.45	17.83	-6.19	Unemployment	4.8	-2.8
									-36.9

Includes persons in the Armed Forces.

^{*/} This information is for the original State Planning Sub-region 1, containing only Allegany, Cattaraugus and Chautauque Counties. Unless otherwise noted, all other references to State Planning Sub-region 1 are for a six-county area (see Appendix E for boundary).

State Planning Sub-region 4 */

This area includes eight Pennsylvania counties in the north-west corner of Appalachia.**/ These counties have a diversity of terrain, grading from hilly forested lands in the southeast to rolling and, finally, flat lake plains along Lake Erie. The counties are linked by transportation routes to each other and to Erie, which is the trading center for most of State Planning Sub-region 4. Venango County is the center of Pennsylvania's oil-producing area, and here petroleum equipment and by-products lead the list of diverse manufacturers. Dairying is the principal agricultural activity.

Lawrence and Mercer Counties are linked in terms of trade, commuting, and transportation to the Youngstown metropolitan area which is just outside the Appalachian Region. Within these counties are New Castle and Sharon-Farrell, two important centers of manufacturing and steelworking. Agriculture within Lawrence and Mercer Counties is dominated by dairying, fruits and vegetables.

Erie, the third largest city in the Commonwealth of Pennsylvania, has long been a dominant influence on trade and economic development in State Planning Sub-region 4. The Erie metropolitan area contains more than a third of the area's 721,900 persons, the remaining two-thirds being largely concentrated around the urban centers of New Castle, Sharon, Farrell, Oil City and Franklin.

Figure 11-25 indicates the portion of population and employment in Water Sub-region F that is located in State Planning Sub-region 4.

*/ See Pennsylvania State Water Supplement in Part V, Main Report.

**/ The eight Pennsylvania counties within State Planning Sub-region 4 include: Clarion, Crawford, Erie, Forest, Lawrence, Mercer, Venango, and Warren.

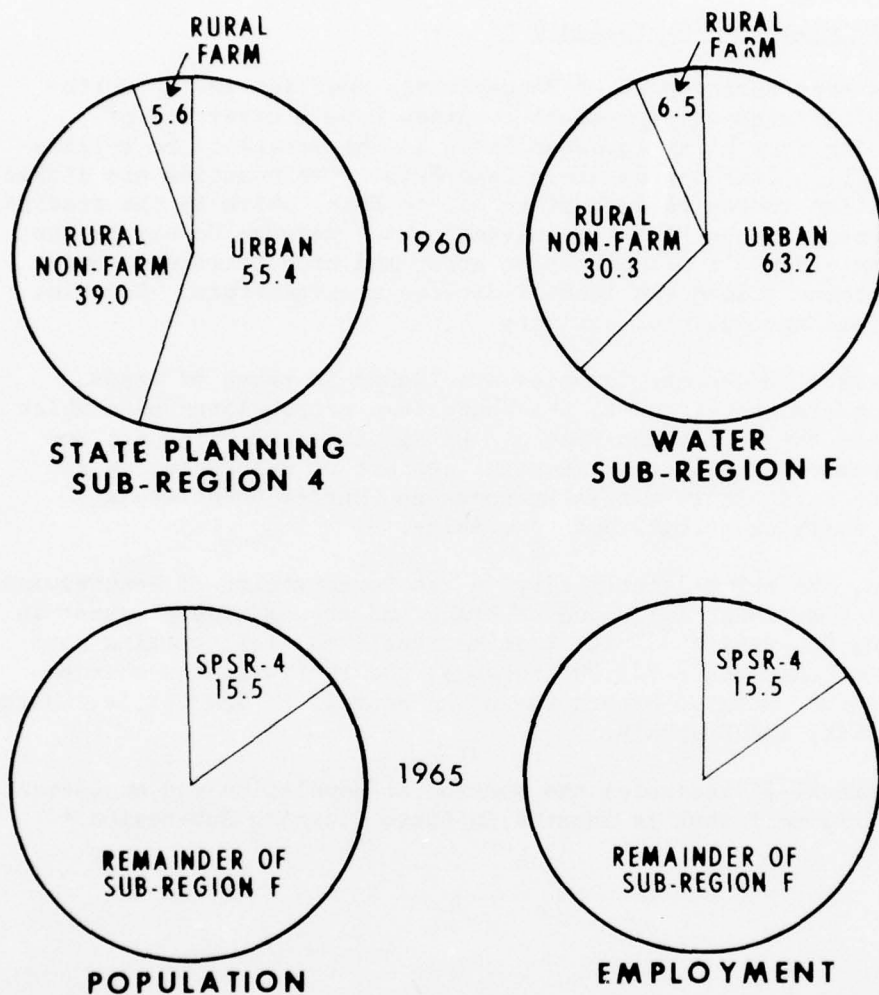


Figure 11-25 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 4 Compared to Sub-region F.

State Planning Sub-region 4 is slightly less urban than Water Sub-region F. In 1960, the combined population of these northwestern Pennsylvania counties was classified as about 55 percent urban, 39 percent rural non-farm and 6 percent rural farm. (See Figure 11-25.)

The population of State Planning Sub-region 4 increased 8.5 percent during the period 1950-1965: this rate, though moderate, is as

high as that experienced in any State Planning Sub-region within the Water Sub-region during this period, and is equaled within the Water Sub-region only by the counties of State Planning Sub-region 1.

There are 258,800 persons employed in State Planning Sub-region 4. Of this employment, service industries account for about 47 percent and manufacturing industries about 42 percent. Manufacturing employment increased during the period 1960-1965 at a rate of about three times that of service industry employment. Within manufacturing, the chemicals and petroleum sector exhibits the highest rates of growth, a rate of 6.8 percent; this rate appears modest, however, in comparison with growth in the chemicals and petroleum sector in other parts of Water Sub-region F.

Important in understanding the State Planning Sub-region's present economy and economic potential is its geographical situation between other planning areas where there is intense specialization in steel and steel-related manufacturing. Employment trends within the steel industry in this area usually vary in response to fluctuations in the national economy and to changes occurring in the industry, such as government defense spending, automation, steel imports and competition from other materials. Although employment in the steel industry, as in the nation, is not expected to increase significantly in the future, steel will continue to play a major role in these counties, assuming it is able to maintain its share of the total industry.

In 1965, the total civilian labor force in State Planning Sub-region 4 numbered about 270,000, with about 11,200 persons unemployed. The unemployment rate was 4.2 percent. There has been a significant reduction in the unemployment rate during the past few years. During the period 1960-1965, the number of unemployed has declined by about 40 percent.

Of all persons 25 years of age and over, within State Planning Sub-region 4, 4.2 percent have less than 5 years of schooling, this compares to 9.5 percent for the Appalachian Region and 6.8 percent for the nation. By this measure, State Planning Sub-region 4 ranks second among State Planning Sub-regions within Water Sub-region F; State Planning Sub-region 1 discussed previously ranks first with 3.3 percent having less than 5 years of schooling.

New Interstate 79, running north-south through this area from Pittsburgh to Erie, bisecting Lawrence, Mercer, Crawford and Erie Counties provides good access to market areas to the north and south. Interstate 80, running east to west through Mercer, Venango and Clarion Counties, provides access to the New York and Cleveland market areas. Interstate 90, extending along the shore of Lake Erie, connects this part of the state planning sub-region to these same market areas. These new transportation systems provide locational advantages to the attraction of plants to this area. Industrial parks are available to accommodate projected growth in employment. A favorable factor that

may further induce new industry is the large labor force, which is relatively high-skilled. The availability of raw materials and natural resources support a wide-based industrial mix which provides the necessary attributes for growth industries applicable to this area such as rubber and plastic products, fabricated metals, instruments, food and kindred products, lumber products, and petroleum products.

Erie Metropolitan Area. In Erie, State Planning Sub-region 4 boasts Pennsylvania's only port on the Great Lakes and a well protected harbor which has a capability to handle large volume shipments of pulpwood, iron ore, limestone, grain, oil and other low value-to-weight cargo. Steelmaking, oil, and gas production, forestry, farming and fruit orchards provide major sources of employment and income within the State Planning Sub-region. An abundance of mineral resources including oil, natural gas, clay and limestone support significant cement, iron and steel industries. Other major manufacturers include machinery, transportation equipment, rubber and paper.

The Erie Metropolitan Area includes, in addition to the Greater Erie Area (138,000 population in 1960), the City of Corry (8,000 population), and smaller population centers Northeast (4,200) and Union City (3,800). The City of Erie, abutting the shores of Lake Erie, has increased in population from 117,000 in 1940 and 130,000 in 1950. Erie County had a population of about 251,000 in 1960: an increase from about 181,000 in 1940 and 219,000 in 1950. The Erie suburban area, principally Harborcreek and Middlecreek Townships have had a population growth from about 10,000 in 1940 to 40,000 in 1960, exhibiting significant growth potential. As a growth entity, this indicates that Erie and its immediate suburban environs have about 70 percent of the total county population.

A moderate 14 percent increase in population from 1950 to 1960 ranked Erie second among the five major metropolitan areas in the sub-region in this respect.*/

Erie ranks third among the sub-region's five major metropolitan areas in the general employment classifications of both manufacturing and finance-trade-services-government, expressed as percentages of total employment; both figures for Erie are about 41 percent. The 18 percent increase (1950 to 1960) in finance-trade-services-government employment moved Erie into second among the metropolitan areas. In contrast, the area's manufacturing and employment underwent the greatest decline of any of the five metropolitan areas (12 percent) between 1950 and 1960, while regaining its economic footing and somewhat diversifying its base.

*/ The five major metropolitan areas include: Pittsburgh, Erie Steubenville-Weirton, Wheeling and Youngstown-Warren.

The employment losses in Erie's electrical and nonelectrical machinery industries (from almost 18,000 in 1950 to about 9,000 in 1960) have more or less been offset by the employment gains in other major industrial groupings, particularly in transportation equipment.

Over one-fourth of total value added by manufacture in the Erie area stems from the combined groupings of electrical and nonelectrical machinery and equipment, despite their large reductions in employment. The machinery industries, therefore, continue as Erie's most important manufacturing activities. The primary and fabricated metals industries together rank just a shade less important than the machinery groupings, as determined by value added by manufacture or total employment.

In Corry, the area's second largest manufacturing center, several large plants with a combined employment of over 1,000 persons produce steel springs and metal office furniture. Smaller plants (100 to 200 employees) manufacture iron and steel forgings, internal combustion engines, and aircraft equipment.

Girard, Fairview, and Lake City, contiguous to the City of Erie on the west have manufacturing plants which offer employment in such lines as plastics, control equipment and die castings.

Protected Erie Harbor offers the sub-region a contact with ports of all continents of the world. The Port of Erie offers the finest in dock facilities to large transport ships. Bituminous coal, oil, petroleum products, lumber, machinery, and steel products are the major imports.

Youngstown-Warren Metropolitan Area */ Located just to the west of State Planning Sub-region 4 is the Youngstown-Warren metropolitan area. Although this area is outside of the Appalachian Region as such, it forms a continuum of Water Area F-1 and State Planning Sub-region 4, exerting, as it does, a profound influence on west-central and southwestern Pennsylvania.

The population of Youngstown-Warren in 1960 was 509,000 persons. During the previous ten-years from 1950, the area experienced a growth of 22 percent.

Mahoning and Trumbull Counties are part of the steel-producing and steel-using manufacturing complex of northeastern Ohio and western Pennsylvania, related to Cleveland and to Pittsburgh in industrial structure, but more highly specialized than either.

*/ Statistical Profile, Youngstown-Warren metropolitan area data, publication of the Federal Reserve Bank of Cleveland, 1968.

Steel dominates the production and employment scene in Youngstown-Warren. In 1960, the primary metals industries claimed slightly more than 46,000 workers, or 57 percent of the total manufacturing work force, and accounted for \$435.5 million, or 55 percent of all value added by manufacture.

According to the 1960 Census count, plants fabricating metal products engaged the services of 7,500 persons in the Youngstown-Warren area; the electrical and nonelectrical machinery industries each employed about 5,000 persons. Other manufactured products include: bakery goods, men's and boys' trousers, fabricated rubber goods, metal doors and sash, metal stampings, industrial boilers, metal working machinery, lamps, mufflers for automobiles and railroad cars.

Since employment in this area is so heavily weighted toward manufacturing, the proportion of the labor force in finance-trade-services-government is low. During the 1950's and early 1960's, however, the number of persons engaged in providing financial services in the area has registered a large percentage increase. This may continue and lend support to a substantial employment increase.

Meadville. The county seat of Crawford County contains approximately 50 percent of the county's population within its urban area. It is the county's retail trade center and the site of Allegheny College. Although livestock production and the growing of grapes contribute to the economic base of the area, manufacturing dominates the employment picture with a viscose plant and zipper factory employing approximately 3,100 persons. The unemployment rate has been dropping and with completion of Interstate Routes 79 and 80 offering excellent accessibility to markets, the future growth potential is considered good.

Franklin-Oil City. Manufacturing accounts for about one-third of this area's employment with 30 percent of this in the high wage category and 60 percent in the medium wage category. Natural resources, especially oil, are abundant in the area and contribute to the economic base. Most factories in the area (90%) employ less than 20 persons which suggests a wide range of diversification. Existing industry in the area is expanding and the completion of Interstate Route 80 provides a favorable growth potential.

Statistical Summary. Statistical data relating to the economy of State Planning Sub-region 4 are given in Tables 11-14 and 11-15.

TABLE 11-14
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
PENNSYLVANIA STATE PLANNING SUB-REGION 4

	<u>1950</u>	<u>1960</u>	<u>Absolute Change</u>
TOTAL ALL SECTORS	239,559	247,019	7,460
PRIMARY ACTIVITIES	22,802	12,680	-10,122
Agriculture	17,182	10,106	- 7,076
Forestry & Fisheries	293	206	- 87
Mining	5,327	2,368	- 2,959
SECONDARY ACTIVITIES	109,510	108,962	- 548
Contract Construction	10,656	10,259	- 397
Food & Kindred Products	3,495	4,611	1,116
Textile Mill Products	391	387	- 4
Apparel	455	315	- 140
Lumber, Wood Products, Furniture	4,336	3,768	- 568
Printing & Publishing	2,521	3,284	763
Chemicals & Allied Products	2,694	2,350	- 344
Electrical & Other Machinery	34,043	25,489	- 8,554
Motor Vehicles & Equipment	542	753	211
Other Transportation Equipt.	2,087	7,752	5,665
Other & Miscellaneous	48,290	49,994	1,704
TERTIARY ACTIVITIES	103,703	117,044	13,341
Transportation & Communi- cations	16,785	13,869	- 2,916
Utilities & Sanitary Service	3,519	3,595	76
Wholesale Trade	4,948	5,473	525
Retail Trade	33,863	35,631	1,768
Finance, Ins. & Real Estate	4,660	6,678	2,018
Personal Services	14,321	14,324	3
Professional Services	18,864	29,691	10,827
Recreational Services	1,365	1,520	155
Public Administration	5,183	5,987	804
Armed Forces	195	276	81
NOT REPORTED	3,544	8,333	4,789

TABLE 11-15
SOCIO-ECONOMIC CHARACTERISTICS
PENNSYLVANIA STATE PLANNING SUB-REGION 4
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1966		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	735,000	Number	721,892	354,387	367,505	40,813	281,358	399,721
Absolute Change 1960-1966	13,000	Percent						
Percent Change 1960-1966	1.8	Distribution	100.00	49.09	50.91	5.65	38.98	55.37
		Percent Change 1950-1960	8.27	7.22	9.30	-55.38	39.97	6.83

DISTRIBUTION OF FAMILIES BY INCOME, 1960						
	Under \$2000	\$2000- \$2999	\$3000- \$5999	\$6000- \$9999	\$10,000 & Over	Total
Number	18,070	13,328	72,188	59,272	20,008	182,866
Percent Distribution	9.88	7.29	39.48	32.41	10.94	100.00
Percent Change 1950-1960	-49.86	-61.90	1.77	357.52	482.47	10.01

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960				
	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	404,224	142,515	202,095	50,990
Percent Distribution	100.00	35.26	50.00	12.61
Percent Change 1950-1960	4.71	-12.90	22.77	18.90

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960						RATE OF UNEMPLOYMENT, 1962-65	
	Total	Male		Female		1962	1963
	Employed	Unem- ployed	Employed	Unem- ployed	Employed	Unem- ployed	1964
Number	246,743	19,234	173,397	13,124	73,346	6,110	1965
Percent Distribution	92.77	7.23	92.96	7.04	92.31	7.69	4.2
Percent Change 1950-1960	3.08	44.40	-3.39	20.02	22.48	156.18	

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960						PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT		
	Total		Male		Female		1965	Chng. 1962-65
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	Number	%
Number	266,253	242,376	186,793	58,170	79,460	184,206	Tot. Work Force	270.0
Percent Distribution	52.35	47.65	76.25	23.75	30.14	69.86	Tot. Employment	12.8
Percent Change 1950-1960	5.29	-0.82	-1.99	8.62	27.55	-3.47	Unemployment	-50.5

Includes persons in the Armed Forces.

State Planning Sub-region 6

This planning sub-region*/ occupies the least populated area of Pennsylvania. There are no large cities and the dominant characteristic is large tracts of forested mountainous country separating scattered small settlements. Low population density and circuitous alignments of highways make for poor accessibility. Much of the sub-region is in national or state forest, and there are considerable recreation resources. The two northern counties, McKean and Potter, look toward the counties across the state line in New York for much of their employment, trade, and services. (See Figure 11-26.)

Clearfield and Jefferson Counties are alike in that they have a declining soft coal mining industry and consequent employment and population losses. In these two counties there is more agricultural land than in the others of State Planning Sub-region 6.

In 1965, State Planning Sub-region 6 contained about 244,000 persons and total employment stood at about 84,400 workers. Manufacturing employment accounted for about 39 percent of total employment and services employment about 45 percent.

During the period 1960-1965, population increased less than 1 percent, while total employment declined about 6 percent. Relative losses in employment were greatest in the construction, mining and trade sectors. Although services employment declined generally during this period, private services employment increased about 26 percent. Notable increases occurred in two other sectors, agriculture, forestry and fisheries and government; both increased approximately 13 percent.

In 1965, the total civilian labor force numbered about 89,200, about 4,800 of these were unemployed; an unemployment rate of about 6.2 percent. During the period 1960-1965, the percentage change in the unemployed was about 43 percent decrease.

One of the largest stands of timber in the eastern United States is found in State Planning Sub-region 6, where commercial forests and public-owned parks and gameland account for more than half of the total land area.

Economic and social interests of most of the area's 240,000 population are strongly tied to several small urban areas which constitute regional centers for trade and commerce -- Bradford (1960 population of 15,000), DuBois (10,700), Clearfield (9,300), Punxsutawney (8,800), and Johnsonburg (5,000).

*/ State Planning Sub-region 6 includes six Pennsylvania counties: Cameron, Clearfield, Elk, Jefferson, McKean and Potter.

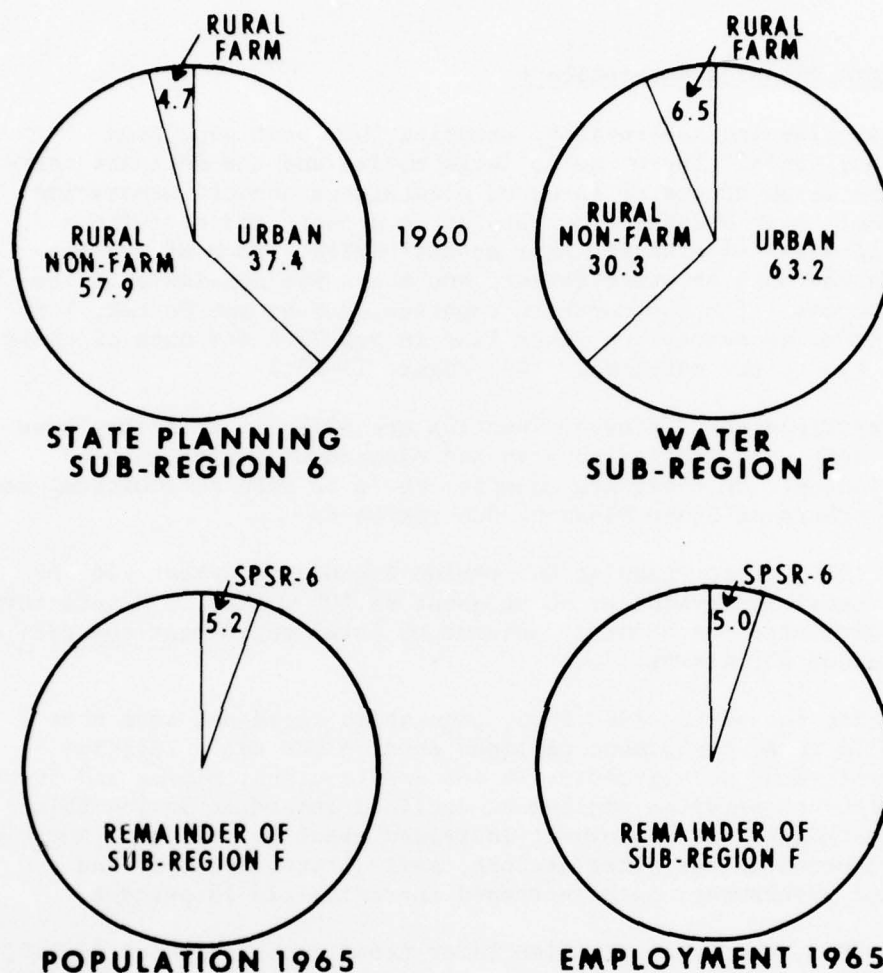


Figure 11-26 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 6 Compared to Sub-region F.

Electrical machinery, stone, clay and glass, and fabricated metal industries are the major employers in State Planning Sub-region 6. Mineral extraction, while declining, continues to produce three million barrels of crude oil annually. Natural gas reserves, east of the Bradford oil fields, provide fuel for glass and other industries. Bituminous mining is also conducted throughout the southernmost counties. Forests in the state planning sub-region attract thousands of visitors annually and support significant primary and secondary wood-using industries.

Overall growth has been relatively slow in the sub-region due to geographic isolation and lack of major urban areas. Community leaders now point to overcoming the transportation disadvantages of the area

with the completion of the Keystone Shortway and improved linkage with the Pittsburgh metropolitan area from a proposed Allegheny Valley Expressway. Improved access will play a key role in developing the area's almost unlimited potential as a recreation and tourist area.

Ridgway-St. Marys-Emporium. The improvement of U.S. Route 219 through this area, between Interstate Route 80 and the Southern Tier Expressway in New York will help growth in this area. The greatest source of employment within the manufacturing sector is in electrical machinery, followed by furniture and paper products, fabricated metals and primary metals. Employment growth is expected to continue in these sectors and also in printing and publishing. The powdered pressed metal molding industry in the primary metal sector has contributed the greatest growth in employment.

Clearfield-DuBois. Clearfield and DuBois are the major urban centers in the southern portion of State Planning Sub-region 6. The apparel sector in manufacturing along with food and kindred products, leather products and instruments are the major sources of employment in Clearfield and Jefferson Counties. Punxsutawney, Brockway, Brookville, Reynoldsville, Philipsburg and Curwensville are minor urban centers in this area. The Keystone Shortway, Interstate Route 80 will help stimulate growth in this area.

Statistical Summary. Statistical data relating to the economy of State Planning Sub-region 6 are given in Tables 11-16 and 11-17.

TABLE 11-16
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
PENNSYLVANIA STATE PLANNING SUB-REGION 6

	<u>1950</u>	<u>1960</u>	<u>Absolute Change</u>
TOTAL ALL SECTORS	86,053	81,533	- 4,520
PRIMARY ACTIVITIES	18,533	8,794	- 9,739
Agriculture	5,212	2,808	- 2,404
Forestry & Fisheries	225	103	- 122
Mining	13,096	5,883	- 7,213
SECONDARY ACTIVITIES	31,830	33,599	1,769
Contract Construction	4,226	4,239	13
Food & Kindred Products	1,195	1,163	- 32
Textile Mill Products	380	152	- 228
Apparel	1,182	1,326	144
Lumber, Wood Products, Furniture	1,864	2,071	207
Printing & Publishing	701	1,071	370
Chemicals & Allied Products	614	479	- 135
Electrical & Other Machinery	9,624	9,260	- 364
Motor Vehicles & Equipment	46	210	164
Other Transportation Equipt.	75	140	65
Other & Miscellaneous	11,923	13,488	1,565
TERTIARY ACTIVITIES	34,628	36,573	1,945
Transportation & Communi- cations	5,621	4,564	- 1,057
Utilities & Sanitary Service	1,244	1,522	278
Wholesale Trade	1,603	1,701	98
Retail Trade	10,615	11,354	739
Finance, Ins. & Real Estate	1,432	1,681	249
Personal Services	5,895	5,241	- 654
Professional Services	5,873	7,800	1,927
Recreational Services	336	380	44
Public Administration	1,958	2,254	296
Armed Forces	51	76	25
NOT REPORTED	1,062	2,567	1,505

TABLE 11-17
SOCIO-ECONOMIC CHARACTERISTICS
PENNSYLVANIA STATE PLANNING SUB-REGION 6
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1966		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	243,600	Number	244,240	119,687	124,553	11,645	141,394	91,201
Absolute Change 1960-1966	-600	Percent Distribution	100.00	49.00	51.00	4.77	57.89	37.34
Percent Change 1960-1966	-0.3	Percent Change 1950-1960	10.84	9.29	12.36	-52.09	39.55	-3.73

DISTRIBUTION OF FAMILIES BY INCOME, 1960						
	Under \$2000	\$2000- \$2999	\$3000- \$5999	\$6000- \$9999	\$10,000 & Over	Total
Number	7,871	6,088	27,357	16,879	5,454	63,649
Percent Distribution	12.37	9.56	42.98	26.52	8.57	100.00
Percent Change 1950-1960	-51.87	-57.37	39.26	445.36	499.34	13.87

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960				
	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	138,159	59,551	62,732	13,791
Percent Distribution	100.00	43.10	45.41	9.98
Percent Change 1950-1960	11.28	-4.25	33.33	21.94

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960							RATE OF UNEMPLOYMENT, 1962-65	
	Total		Male		Female		1962	1963
	Employed	Unem- ployed	Employed	Unem- ployed	Employed	Unem- ployed	1964	1965
Number	81,457	8,408	55,872	6,068	25,585	2,340	10.5	10.0
Percent Distribution	90.64	9.36	90.20	9.80	91.62	8.38	8.1	5.4
Percent Change 1950-1960	5.93	68.06	-1.37	44.41	26.34	192.13		

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960							PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT		
	Total		Male		Female		1965 Number	Chng. 1962-65 No.	7
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	Tot. Work Force		
Number	89,941	82,680	62,012	21,218	27,929	61,462	84.4	1.4	1.7
Percent Distribution	52.10	47.90	74.51	25.49	31.24	68.76	Unemployment	4.8	-4.9
Percent Change 1950-1960	9.76	3.83	1.84	13.68	32.64	0.81		-3.8	-50.5

Includes persons in the Armed Forces.

Water Area F-2

Water Area F-2 has been the dominant growth area of the sub-region based on its past performance, representing 60.5 percent of the manufacturing employment of the sub-region and 62.3 percent of its commercial employment. This would indicate that it has the highest potential, and possesses probably the most strategic location as to growth possibilities, even though its growth rate has not been uniform and as high as Water Area F-1, mainly due to restrictions placed on it by its infrastructure.

The existing developments of Pittsburgh, Allegheny County, have utilized to a rather mature extent many of its more attractive environmental sites, particularly with respect to water borne transportation. However, the contiguous Counties of Beaver, Butler, Armstrong, Washington, and Westmoreland, with their relatively new urban centers, as compared to Pittsburgh, appear to offer indications of better potential for future growth. These growth centers are Kittanning, Ford City, Butler, Aliquippa, Beaver Falls, Washington, Canonsburg, Donora, New Kensington, Monessen, Greensburg and Uniontown. The existing industrial mix shows a concentration in the primary metals, which in this area is almost totally steel. Fabricated metals and machinery represent national growth industries which are prevalent in Water Area F-2. The trend in new plants in these industrial sectors has been in the counties surrounding Allegheny County.

The chemical industry and the aluminum are national growth industries which could take further advantage of the area's strategic location.

An on-going phenomena in the southwestern Pennsylvania region is the development of corporation headquarters with a trend toward huge central administrative offices. This reflects an expansion of headquarters by major companies firmly established. The Pittsburgh Standard Metropolitan Statistical Area in 1960 had more firms with headquarters offices than any metropolitan area in the United States except New York and Chicago.

State Planning Sub-region 5

The focus of these Pennsylvania counties is toward Pittsburgh in terms of transportation, trade, commuting and services.*/ In Pittsburgh, almost half of the manufacturing labor force is employed in the

*/ State Planning Sub-region 5 includes the nine Pennsylvania counties: Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Washington and Westmoreland.

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DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. MAIN REPORT. PART--ETC(U)

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steel industry. The industry is not concentrated, but is scattered in smaller cities throughout the sub-region. Pittsburgh is the largest city in Appalachia, with many wholesale, financial, and commercial activities not related to steel making. Figure 11-27 shows the proportion of population for Water Sub-region F in State Planning Sub-region 5.

The combined population of the nine counties numbers 2.8 million and represents nearly half the population of Appalachian Pennsylvania. Approximately 60 percent of the state planning sub-region's population resides in the Pittsburgh area, with the remainder concentrated in the Towns

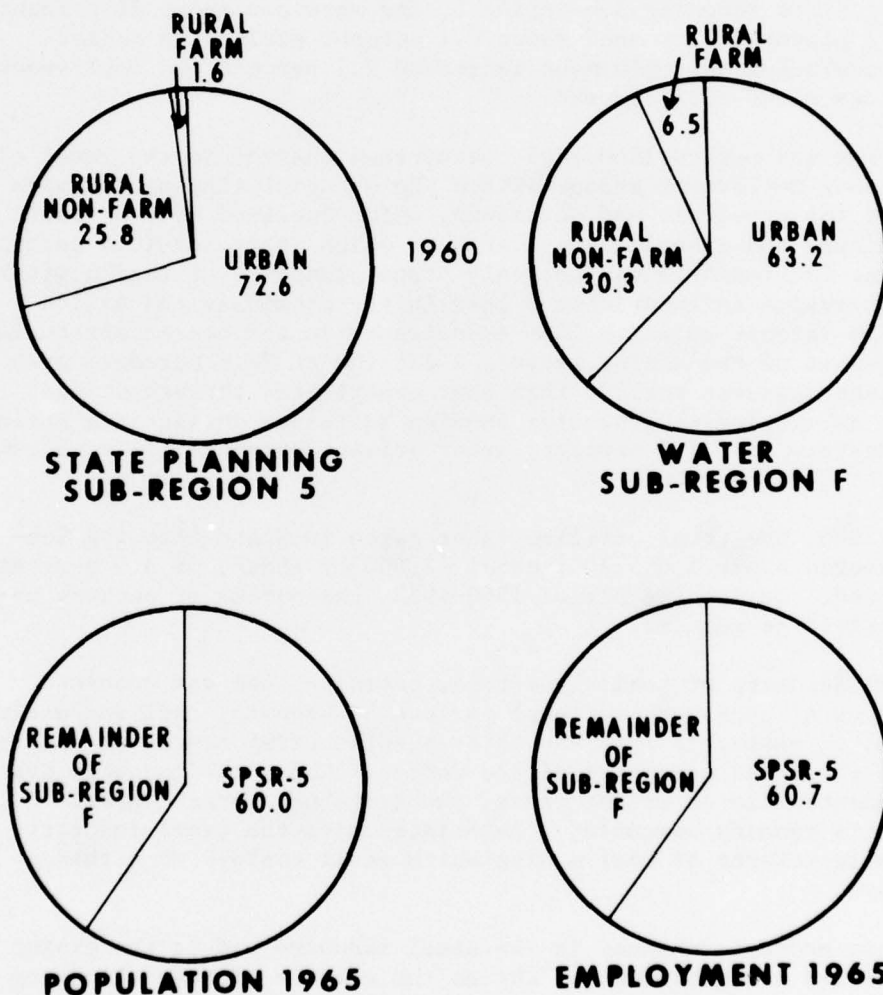


Figure 11-27 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 5 Compared to Sub-region F.

of Aliquippa, Washington, New Kensington, Butler, Uniontown, Greensburg, Monesson, Jeannette, and Beaver Falls. The settlement pattern of this area is characterized by the urban corridors which radiate from Pittsburgh along the Ohio, Allegheny and Monongahela Rivers.

In 1960, the sub-region's population was about 73 percent urban, 26 percent rural non-farm and 2 percent rural farm. During the period 1950-1965, there was a population increase of about 4 percent. (Figure 11-27.)

In 1965, manufacturing accounted for about 35 percent of total employment in State Planning Sub-region 5, and services about 56 percent. While total employment increased about 6.1 percent during the period 1960-1965, manufacturing employment increased 2.7 percent and employment in the services about 10.1 percent.

During the period 1960-1965, percentage changes in the level of employment among employment groups within the manufacturing sector were minor, except for chemicals and petroleum, which declined -6.9 percent, and the machinery and miscellaneous category which increased 10.4 percent. State Planning Sub-region 5 was the only state planning sub-region within the water sub-region to experience a loss in the chemicals and allied products. The largest relative loss experienced in the non-manufacturing category was that of the mining sector, a decline of 22.4 percent; even this percentage loss was smaller than that experienced throughout most of the water sub-region. Categories showing increases during this period include: construction, 7.7 percent; other private services, 24.6 percent; and government, 12.7 percent.

In 1965, the total civilian labor force in State Planning Sub-region 5 numbered about 1,059,700; about 42,600 of these, or 3.9 percent, were unemployed. During the period 1960-1965, the number of persons unemployed declined 56 percent.

Rich deposits of coal, limestone, petroleum and gas combined with advantages of access to national markets by highway, rail and water, have combined to make this area the major manufacturing center of Appalachia and the steel-making center of the nation. While the industry has tended to decentralize in recent years, the Pittsburgh area's steel-making capacity remains unequaled. Associated with the steel industry has been the importance of coal mining which still employs more than 15,000 workers.

Basic economic changes in the steel industry and in the mining industry have had a significant effect on the economy of State Planning Sub-region 5. The impacts of technology, decreasing demand and changes in the locational requirements have reduced the manpower requirements of these industries. Nearly 50,000 persons in the labor force have left the area since 1958 to seek employment opportunities elsewhere resulting in a net population loss of nearly 100,000. More recently, out-migration

has been reduced and total population in some areas is now trending upward.

While this planning area has been attracting new and diversified industry in recent years, employment remains heavily concentrated in primary metals; and the increase in trade and service sectors has not been as extensive as in other major urban areas of the United States. Overall, in spite of previous setbacks, the local economy is apparently making a successful adjustment to economic change.

Two sub-areas of State Planning Sub-region 5 exemplify some of the basic manpower problems faced in many parts of Appalachia Pennsylvania. For several years, the Fayette County labor market area has been a problem area in terms of unemployment. Here, unemployment has been closely tied to the mining industry which, in 1940, employed more than 20,000 persons. Depletion of economically recoverable coal has left fewer than 1,500 miners working in this area. Major out-migration has resulted in significant population losses and an accompanying decline in the labor force. More than 40,000 people have left the labor market area since 1950, with the labor force dropping from 52,000 to a present level of 41 thousand. Other economic sectors in the area also have felt the impact of decline. Presently more than 3,000 remain jobless representing an annual loss of at least \$15 million in regional and national income.

Today, the Uniontown-Connellsville area is undergoing a period of adjustment, turning its emphasis from coal production to the establishment of new and diversified industries. A major effort is needed to gear the present labor supply to the manpower needs of existing and potential industries by training and retraining programs.

Pittsburgh Metropolitan Area.*/ In terms of metropolitan area classification of the 1960 Census, the four-county metropolitan area of Pittsburgh had a population of 2,406,000 people. Pittsburgh's largest suburb, Penn Hills Township, more than doubled its population from 25,280 in 1950 to 51,512 in 1960. The City of McKeesport numbers over 45,000, while Mount Lebanon and Wilkinsburg each has a population in excess of 30 thousand. Other cities, boroughs, or townships surrounding the City of Pittsburgh with populations between 20,000 and 30,000 are, in order of size: West Mifflin, Ross Shaler, Baldwin, Bethel, and Monroeville.

In Beaver County the population of Aliquippa Borough has remained virtually unchanged at 26,000 between 1950 and 1960. Beaver Falls and Ambridge, also within Beaver County, have populations between 13,000 and 16 thousand.

*/ In the preparation of this material on the Pittsburgh Metropolitan Area use was made of Cross Sections, a publication of the Federal Reserve Bank of Cleveland.

Washington is the largest city in Washington County, with a population of 26,000, while Canonsburg and Donora each has over 11 thousand people.

Within Westmoreland County, the largest population centers are Hempfield and New Kensington. Other cities or boroughs with populations ranging down to 10,000 are: Monessen, Greensburg, Jeannette, Lower Burrell, Latrobe, and Mount Pleasant.

Population growth in the four-county Pittsburgh SMSA was a comparatively low 9 percent from 1950 to 1960, more than half of which occurred in Allegheny County.

In 1960, the industrial complex of the Pittsburgh area contributed \$2.9 billion in manufacturing value added. Total manufacturing employment has shown only a nominal gain of 1 percent during the ten-year period ending in 1960.

The industrial composition of the hub, four-county Pittsburgh area is heavily weighted by the primary metals industry grouping, which accounts for 40-45 percent of total manufacturing employment. The iron and steel industry is important throughout the four counties, although Allegheny County is clearly the center.

A great diversity of steel and related products is manufactured, ranging from pig iron and heavy steel ingots to finely drawn steel wire. Several large integrated steel plants, each employing over 5,000 persons, combine the operations of blast furnaces, steel works, and rolling mills while smaller firms (many with less than 50 employees) produce iron and steel forgings.

In addition to the basic iron and steel industry there are a number of firms, each of which employs up to 1,000 workers, which manufacture basic shapes of aluminum, brass, bronze, and copper. A zinc smelting plant with more than 1,000 employees is located in Beaver County.

Pittsburgh has an estimated annual capacity of 32 million tons of iron and steel. Production in 1962 exceeded one-fifth of the nation's total and makes it the country's largest iron and steel making center. The area's relative share of the total national capacity, however, has been declining. This is the result of heightened competition from foreign and domestic steel producers, the substitution^{*/} of materials

^{*/} Some examples in which aluminum has replaced steel are containers, bridges, highway guard rails, furniture, curtain walls, motor vehicles, and trailers. Glass has become a structural building material in some cases replacing steel sheathing. Plastic gears have better wearing characteristics and are quieter in some applications than steel.

such as aluminum, concrete, glass, plastics and timber, the geographical shift in steel consumers and the westward migration of a part of the iron and steel industry.

High labor costs are presently the key factor in the substitution of other goods for steel and transportation costs of raw materials are the important considerations in the location of new steel plants. While Pittsburgh has a locational and transportation advantage in coal, the midwest has transportation advantages for ore. Since a larger tonnage of ore than coal is now used, this provides a locational advantage to the midwest.

The second most important industry in the Pittsburgh area in 1960 was fabricated metal products, which accounted for 10 percent of both manufacturing employment and value added by manufacture.

Nonelectrical machinery is the next most important industry; it contributed 9 percent of the value added in manufacturing in 1960 and provided for 7 percent of the area's manufacturing employment.

Electrical machinery ranks fourth in importance among industries; this grouping accounted for 7 percent of manufacturing employment while it produced 9 percent of value added by manufacturing in 1960.

The food and kindred products industry provided employment for over 18,000 persons (6 percent of manufacturing employment); value added by manufacture was over \$200 million (7 percent of the total in manufacturing) for the Pittsburgh Metropolitan Area.

Good supplies of clay, sand, and natural gas in the Pittsburgh area facilitate the manufacture of stone, clay, and glass products. This grouping accounted for roughly 5 percent of both manufacturing employment and value added by manufacture in 1960.

The Pittsburgh area^{*/} is endowed with some of the world's richest bituminous coal deposits, constituting a significant percentage of the total deposits in Water Sub-region F. Of a total of 120 million tons mined in the water sub-region in 1965,^{**/} about 55 percent was mined in the Pennsylvania portion and about one-third of this was mined in the hub area (four-county). Most of the coal is used by the steel industry and by the electric utilities for thermal electric energy generation, the latter being the largest single consumer of coal. In maximizing the use of coal, liquid fuel production looms as a feasible and competitive process in addition to the many chemical by-products from the conversion of coal into coke for use in the production of steel.

^{*/} Including deposits in State Planning Sub-region 18.

^{**/} See Appendix I, Mineral Industry - Resources and Water Requirements, for detailed analysis.

Natural gas and crude petroleum are also produced in the area and consumed by local industries. Clay is mined for use in the manufacture of building brick, while sand, stone, and gravel are produced for road construction.

Total mining employment in the Pittsburgh area has undergone a 60 percent decline between 1950 and 1960, to about 12,000 workers. The significance of this attaches mainly to mechanization and not entirely to production, although the latter may be considered to be somewhat absolute to the end of that decade. In 1960, the region mined about 25 million tons, less than one-third as much as in the peak year of 1913. Coal mining, which forty or fifty years ago employed almost as many men in the region as steel industry, is now only about one-eighth as important as steel in terms of jobs. But, it would appear that coal mining may yet experience a rebirth. New mines are opening on the Pennsylvania-West Virginia border which will produce coal for power generation purposes. For the first time in fifteen years or so, coal miners are in very short supply.

Much of the iron ore used in the steel mills is shipped by railroads from the northern port cities of Cleveland, Ashtabula, and Conneaut, Ohio, and Erie, Pennsylvania. This contributes to a high density of railroad freight traffic for the area. Conversely, a large amount of coal is shipped to the Lake Erie area from the Pittsburgh region by truck and rail. Unit train operations are widely used.

Water-borne commerce also plays an important role in the industrial activity of the area. Bulk commodities such as coal, sand and gravel, limestone, petroleum and chemical products readily lend themselves to water transportation. Traffic on the Allegheny River in 1966 amounted to approximately 5.2 million tons, most of which consist of the minerals, coal, sand and gravel. Traffic on the 128.7 mile Monongahela River in 1966 was 40 million tons. Coal amounted to 83 percent of this tonnage which gives the Monongahela River the distinction of having the highest coal density traffic in the world. Most of the coking quality coal is shipped downstream to the steel plants in the lower Monongahela and upper Ohio River regions for use in coke ovens. Also, coal is shipped downstream for use in steam-electric plants. Iron and steel products and bulk raw materials of coal, sand and gravel, chemicals, and petroleum account for the largest part of the annual traffic on that portion of the Ohio River within the Pittsburgh area.

The three major rivers at the Golden Triangle of Pittsburgh thus have been an important determinant in the location of many steel and chemical plants. The resultant situation is not one on which there is (or can be) a clean slate upon which to shape developments whose origins extend back more than 200 years. During the ensuing decades many forces (including the effect of the major rivers) were at work shaping the metropolitan area as it now exists revealing such conglomerate features as the strings of steel mill towns located along the major rivers in the area, and large

industrial complexes such as the world's largest coke and chemical works at Clairton, on the Monongahela River. Water-borne commerce continues to influence the character of development.

Statistical Summary. Statistical data relating to the economy of State Planning Sub-region 5 are given in Tables 11-18 and 11-19.

TABLE 11-18
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
PENNSYLVANIA STATE PLANNING SUB-REGION 5

	<u>1950</u>	<u>1960</u>	<u>Absolute Change</u>
TOTAL ALL SECTORS	961,193	975,910	14,717
PRIMARY ACTIVITIES	89,505	40,619	-48,886
Agriculture	23,211	14,923	- 8,288
Forestry & Fisheries	215	105	- 110
Mining	66,079	25,591	-40,488
SECONDARY ACTIVITIES	391,433	399,899	8,466
Contract Construction	51,341	50,387	- 984
Food & Kindred Products	21,633	24,911	3,278
Textile Mill Products	1,381	601	- 780
Apparel	3,305	4,495	1,190
Lumber, Wood Products, Furniture	4,405	4,667	262
Printing & Publishing	10,287	14,091	3,804
Chemicals & Allied Products	8,428	10,627	2,199
Electrical & Other Machinery	46,248	55,869	9,621
Motor Vehicles & Equipment	2,426	3,504	1,078
Other Transportation Equipt.	6,102	7,730	1,628
Other & Miscellaneous	235,877	223,017	-12,860
TERTIARY ACTIVITIES	470,004	504,846	34,842
Transportation & Communi- cations	71,757	58,304	-13,453
Utilities & Sanitary Service	15,775	16,349	574
Wholesale Trade	28,857	31,075	2,218
Retail Trade	145,459	143,424	- 2,035
Finance, Ins. & Real Estate	28,782	35,576	6,794
Personal Services	63,320	64,547	1,227
Professional Services	77,246	111,517	34,271
Recreational Services	7,939	8,377	438
Public Administration	29,331	33,816	4,485
Armed Forces	1,538	1,861	323
NOT REPORTED	10,251	30,546	20,295

TABLE 11-19
SOCIO-ECONOMIC CHARACTERISTICS
PENNSYLVANIA STATE PLANNING SUB-REGION 5
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1966		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	2,826,000	Number	2,883,728	1,408,836	1,474,892	47,792	742,633	2,093,303
Absolute Change 1960-1966	-57,300	Percent						
Percent Change 1960-1966	-2.0	Distribution	100.00	48.85	51.15	1.66	25.75	72.59
		Percent Change 1950-1960	6.65	4.92	8.37	-62.39	7.28	11.08

DISTRIBUTION OF FAMILIES BY INCOME, 1960						
	Under \$2000	\$2000- \$2999	\$3000- \$5999	\$6000- \$9999	\$10,000 & Over	Total
Number	70,832	52,253	273,343	240,784	107,705	744,917
Percent Distribution	9.51	7.01	36.70	32.32	14.46	100.00
Percent Change 1950-1960	-48.07	-64.68	-4.58	249.88	721.55	8.53

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960				
	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	1,676,493	656,642	762,727	215,792
Percent Distribution	100.00	39.17	45.50	12.87
Percent Change 1950-1960	4.29	13.70	29.10	24.59

This includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960						RATE OF UNEMPLOYMENT, 1962-65	
	Total	Male		Female		1962	1965
	Employed	Unem- ployed	Employed	Unem- ployed	Employed	Unem- ployed	
Number	974,049	79,353	695,910	60,420	278,139	18,933	9.8
Percent Distribution	92.47	7.53	92.01	7.99	93.63	6.37	8.3
Percent Change 1950-1960	1.50	21.61	-4.72	14.29	21.33	52.85	8.9
							4.0

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960								PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT		
	Total		Male		Female			1965	Chng. 1962-65	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force		Number	No.	%
Number	1,055,263	1,013,132	758,176	236,180	297,087	776,952	Tot. Work Force	1,059,700	-4.5	-0.4
Percent Distribution	51.02	48.98	76.25	23.75	27.66	72.34	Tot. Employment	1,017,100	57.3	6.0
Percent Change 1950-1960	2.81	-0.74	-3.38	5.55	22.89	-2.51	Unemployment	42,600	-61.8	-59.2

Includes persons in the Armed Forces.

Water Area F-3

Water Area F-3 has only 13 percent of total employment of Sub-region F, 11 percent of the manufacturing employment and 13 percent of the commercial employment. This area may be divided into two separate areas, the Ohio Main Stem Area of Hancock, Brooke, Jefferson (Weirton-Steubenville Urban Center); Ohio, Belmont and Marshall (Wheeling Urban Center) and Wetzel County (New Martinsville Urban Center); the second area. The Monongahela Main Stem Area of Monongalia and Marion Counties (Morgantown and Fairmont Urban Centers) and rural Preston County (Kingwood Urban Center). The Stonewall Jackson area of Harrison County (Clarksburg Urban Center), and the rural counties of Taylor, Doddridge, Gilmer and Lewis (Weston and Grafton Urban Centers). Parkersburg (Water Area G-3) has in recent years become a focal point of a remarkable industrial growth which has spread in a linear pattern all along the Ohio River Valley. The value of manufacturing in this area showed a phenomenal increase of 88 percent between 1958 and 1963. The area along the Ohio River between the old industrial complex of Wheeling and the new industrial center of Parkersburg has tremendous growth possibilities.

The industrial mix of the water area is quite divergent in the Wheeling, Weirton-Steubenville area of the upper Ohio main stem. Steel is the predominant manufacturing sector with stone, clay, and glass a distant second. National Steel Corporation in Weirton-Steubenville has retained a sound economic condition, but Wheeling Steel Corporation has operated in the red for the past five years. The decline of this corporation has had severe economic effects in its area. This area called "Little Pittsburgh" because of its similarity to Pittsburgh has had its available land areas intensely utilized in the past. New growth in this area could only occur at the expense of dismantling the old. Marshall and Wetzel Counties have the old glass industry and an emerging chemical industry. This area is not restricted by existing industry and has land and resources available for future substantial growth. The industrial mix of the Monongahela Basin is predominantly in the stone, clay, and glass industry. Mining is the largest non-commercial sector of the economy and although declining in employment, represents an asset in attracting electric utilities and industrial concerns whose use of electrical energy is an important criteria to be considered in their location.

State Planning Sub-region 17 */

The population of State Planning Sub-region 17 plus adjacent Belmont and Jefferson Counties, Ohio, was about 366,000 in 1965. Brooke, Hancock and Jefferson Counties form the Steubenville-Wiarton SMSA, which adjoins the Pittsburgh SMSA on the west. These three counties have strong commuting ties and form a separate retail trade area. However, their employment structure is oriented toward the iron and steel industries located along the Ohio River. These industries are tied to their counterparts in the Pittsburgh area. Population and employment in State Planning Sub-region 17 compared to Water Sub-region F is shown in Figure 11-28.

State Planning Sub-region 17 has a higher percentage of rural farm population and less urban population than water Sub-region F as a whole (See Figure 11-28). The major urban area of the state planning sub-region is located in Belmont, Marshall and Ohio Counties, which form the Wheeling SMSA. The focus of this SMSA plus Wetzel County is on the strip of urban development in the Ohio River Valley which is the center of population and transportation facilities. Steel-making and allied industries are a leading source of employment. The valley has naturally favored north-south communications routes, but east-west accessibility will be greatly improved when Interstate 70, extending across Belmont and Ohio Counties, through Wheeling is completed. The area has lost population since 1950, but the recent establishment of three aluminum plants along the Ohio River in Monroe County may indicate a trend toward future employment and population growth.

*/ State Planning Sub-region 17 includes the four northern Pan-handle counties of West Virginia (Brooke, Hancock, Marshall, and Ohio) plus Wetzel County, West Virginia. Jefferson and Belmont Counties, Ohio, not in State Planning Sub-region 17, have been included in some of the data discussed herein. These counties join with those of State Planning Sub-region 17 in the makeup of the Steubenville-Wiarton and the Wheeling SMSAs. Jefferson County, Ohio is in State Planning Sub-region 11 and Belmont County, Ohio is in State Planning Sub-region 12.

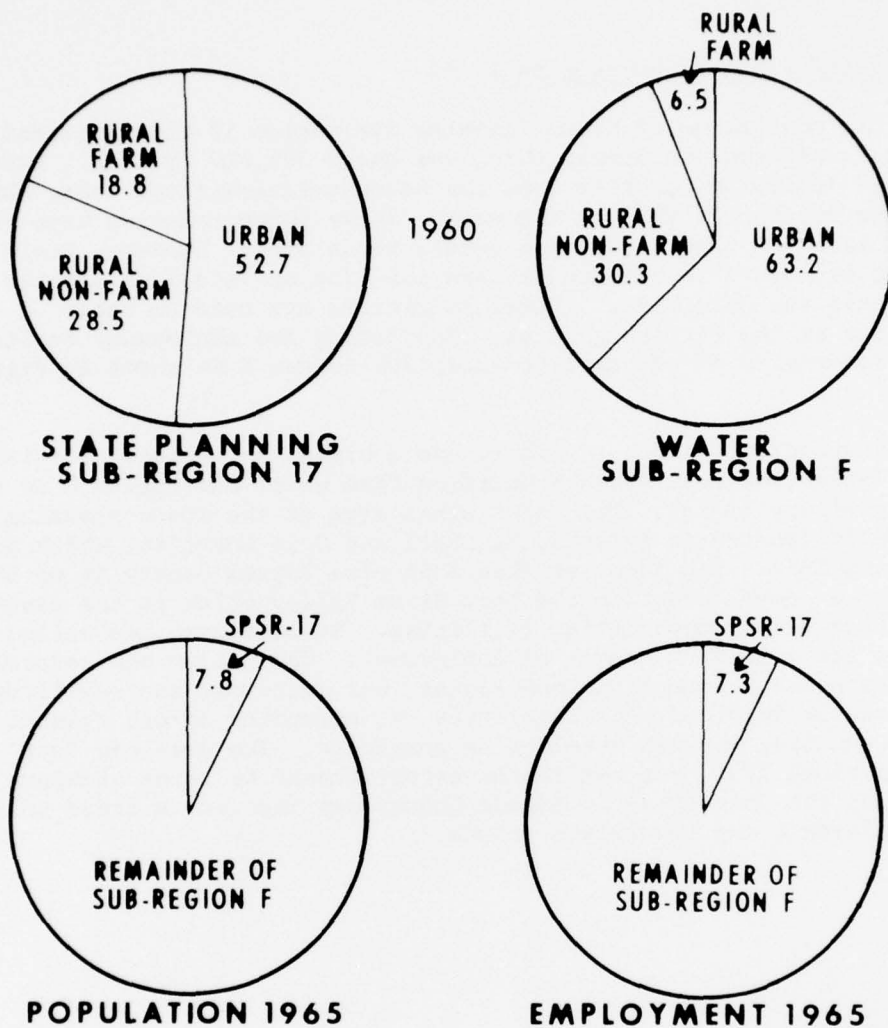


Figure 11-28 - Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 17 Compared to Sub-region F.

In State Planning Sub-region 17, manufacturing is the leading employer - the principal products being primary metals, chemicals, glass, pottery and fabricated metals.

In 1963, value added by manufacture of products amounted to \$147.5 million or about 8.04 percent of the total for the State. Coal, produced in the region, is an important ingredient in the making of steel, chemicals, glass, pottery and is the fuel used in the generating of electric power at four huge plants in the area.

Agriculture used 41.5 percent of the land in State Planning Sub-region 17 in 1964, and produced \$5.3 million worth of marketed products which amounted to about 5.3 percent of the total for the State.

In addition to such factors as plenty of water, good transportation, economical electric power and convenience to markets and materials, this region has a labor force that has been accustomed to industrial occupations for many years. This area was one of the nation's pioneers in the manufacture of steel, glass and pottery.

The orientation of State Planning Sub-region 17 is toward an industrial-residential environment. Local recreation programs, with diversified areas exist at New Martinsville, Follansbee and Wierton, with the most outstanding example in the State provided in Wheeling's Oglebay Park. One of the State's three horse racing tracks, Waterford Park, is located near Chester. Tomlinson Run State Park should also be mentioned.

Water is the main theme of the recreation in this region with all counties bordering on the Ohio River. Existing are four regional public hunting and fishing areas and one State Park.

The two Ohio Counties (Belmont and Jefferson Counties) have close ties with West Virginia State Planning Sub-region 17. Jefferson County is in the Wierton-Steubenville urban complex and Belmont County is in the Wheeling urban complex and comprise a total of 946 square miles, and a combined 1960 population of 183,000, or approximately one-half of the population of Water Area F-3. Manufacturing accounts for about 33 percent of the combined county employment. The leading industries are in primary metals, fabricated metals and glass. This area, like State Planning Sub-region 17, is exposed to plenty of water, good transportation, economical electrical power, convenience to markets and materials and an industrial oriented labor force.

The industrial mix for Jefferson County leans heavily toward primary metals, 79 percent of employment, while Belmont County is slightly more diversified with the addition of fabricated metals and glass. Industrial development is at individual locations which are extended linearly along the river bank, without any growth points of appreciable size. The Tuscarawas Development Region of the State of Ohio, which is weak industrially, includes Jefferson County. Belmont County is in the Ohio Development Region, which is likewise industrially weak. Brilliant, and Yorkville occupy Jefferson County flood plain areas; Dillonvale and Adena are on Short Creek, away from the river. West Wheeling and Bellaire (including Shadyside) and Pawhatan Point are on the river flood plain in Belmont County.

The population of State Planning Sub-region 17 was about 187,500 in 1965, with total employment at about 73,100 workers. Manufacturing employment accounted for about 42 percent of total employment; this was double that employed in service industries.

Although the population of State Planning Sub-region 17 declined 3.55 percent during the period 1960-1965, the increase in employment, 5.6 percent, was greater than that experienced in any other state planning sub-region within the water sub-region. Gains in employment can be accounted for primarily by gains accruing to the manufacturing sector during this period. Largest relative gains were in machinery and wood and paper employment categories. Increases in employment in the construction industry were also large during this period.

Trade, services and government together provided about 80 percent of the total non-manufacturing employment in 1965. During the period 1960 to 1965 declines were experienced in wholesale and retail trade (-32.6 percent) and other private services (-10.4 percent) while increases occurred in government (21.3 percent), agriculture (29.4 percent) and transportation and utilities (16.7 percent).

In 1965, the total civilian labor force in State Planning Sub-region 17 (excluding adjacent Ohio counties) was about 86,000, with about 5,000 persons unemployed. The unemployment rate was 6.2 percent. During the period 1960-1965, the number unemployed declined 1.9 percent.

Steubenville-Weirton Metropolitan Area.*/ The upper Ohio River divides the Steubenville-Weirton Metropolitan Area into Jefferson County (Ohio) and Brooke and Hancock Counties (West Virginia). In 1960, the three counties as a unit ranked 5th among the 5 major metropolitan areas of the sub-region in total population and 4th in population per square mile. Each county shared in the relatively moderate 6 percent increase in population between 1950 and 1960. More than one-half of the people are concentrated in and around the neighboring cities of Steubenville, on the Ohio side of the river, and Weirton, on the West Virginia side.

In Jefferson County the largest city is Steubenville with a population of 32,500 people. To the north of the city is Toronto with 7,800; to the south is Mingo Junction with 5,000; and to the west is Wintersville with 3,600 population.

Weirton is located on the Brooke-Hancock county line, with most of the city's population of 28,000 in Hancock County. It is the only city in the area which has shown any significant population growth

*/ Statistical Profiles, Steubenville-Weirton Metropolitan Area data, Federal Reserve Bank of Cleveland, 1968.

(17 percent) from 1950 to 1960. Along the Ohio River, in Hancock County, the City of Chester has 3,800 population. Just south of Weirton, in Brooke County, are the river cities of Wellsburg with 5,500 and Follansbee with 4,000 population.

In 1960 the Steubenville-Weirton area had the highest percentage of manufacturing employment (47 percent of total employment) among the 5 major metropolitan areas. Approximately three-fourths of the manufacturing employees were engaged in the primary metals industry, principally steel. As a corollary of the heavy concentration of employment in manufacturing, Steubenville-Weirton ranks lowest among the 5 major metropolitan areas in numbers employed in the finance-trade-services-government classification as a proportion of total employment.

In 1960, in the steel community of Weirton, a high concentration of flat rolled steel products were produced. Across the river, at Steubenville, steel production consists chiefly of light-weight steel products. Titanium metal and alloy products are produced at Toronto. Ferrochromium and ferrochrome silicon are produced at Steubenville.

Abundant natural resources, including the Ohio River, have played an important role in the industrial development of the Steubenville-Weirton area, and in the attraction of industry to the Upper Ohio Valley. Most of the manufacturing plants are located along the banks of the river, which is also the case for the neighboring metropolitan area of Wheeling to the south. The waters of the Ohio River are utilized in many industrial processes, as well as for barge transportation of raw materials and finished products.

In 1961, Hancock County ranked high in West Virginia in the output of clay, which is used in foundries and steelworks and for the manufacture of cement, firebrick and block, chinaware, pottery, and sewer pipe. The county was also the first in the production of sand and gravel, supplied by the Ohio River and used in the construction industry.

In 1961 over 3 million tons of bituminous coal, 10 percent of Ohio's total production, were mined in Jefferson County. A substantial amount of clay is also produced in the county.

The median family income of the Steubenville-Weirton metropolitan area was \$6,098 in 1959, or 2nd highest among the 5 metropolitan areas. Also, Steubenville-Weirton ranked 2nd of the 5 major metropolitan areas in terms of percent growth rate in median family income from 1949 to 1959.

Retail sales per capita in 1958 were next to the lowest among the 5 metropolitan areas, although the growth in total retail sales was a shade above the average for the District.

Wheeling Metropolitan Area. The Wheeling Metropolitan Area consists of Ohio and Marshall Counties in West Virginia, and Belmont County in Ohio. A 1960 population of 190,000 placed Wheeling in 4th position among the 5 metropolitan areas, and the average of 201 persons per square mile for the three counties, ranks the area as the least densely populated of the five metropolitan areas. Wheeling is the only metropolitan area of the five which lost a portion of its population (3 percent) from 1950 to 1960.

In the area's largest county, Belmont, the Ohio River cities of Martins Ferry and Bellaire both had populations between 11,000 and 12,000 people. In 1960, the river towns of Shadyside and Bridgeport had 5,000 and 3,800, while Barnesville, 25 miles west of the river, had 4,400 inhabitants.

The population of the corporate city of Wheeling in Ohio County declined over 9 percent between 1950 and 1960 to about 53,000 people.

Marshall County stands alone among the area's three counties in having had a moderate increase in its population during the 1950's. The largest city was Moundsville, numbering over 15,000 in 1960; McMechen and Benwood, also river towns, had in 1960, populations of 3,000 each.

There has been a marked reduction in employment opportunities within the area, stemming in part from plant modernizations, consolidations, and mergers. Manufacturing employment declined 10 percent from 1950 and 1960, and by 1960 accounted for less than 30 percent of total employment. Wheeling manufacturing employment is highly concentrated in the primary and fabricated metals industries. These two industry groups accounted for approximately 50 percent of total manufacturing employment in 1960. A steel company was the area's largest employer.

The percentage of total employment engaged in the finance-trade-services-government in the Wheeling Metropolitan Area is highest of the five major metropolitan areas within the sub-region. That is particularly the case in the City of Wheeling, which is an important wholesaling center for northern West Virginia and southeastern Ohio. Employment growth in the finance-trade-services-government sectors, however, has been a modest 4 percent from 1950 to 1960, ranking Wheeling last in this respect among the 5 metropolitan areas.

Statistical Summary. Statistical data relating to the economy of State Planning Sub-region 17 are given in Tables 11-20 and 11-21.

TABLE 11-20
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
WEST VIRGINIA STATE PLANNING SUB-REGION 17

	<u>1950</u>	<u>1960</u>	<u>Absolute Change</u>
TOTAL ALL SECTORS	69,598	65,710	-3888
PRIMARY ACTIVITIES	7,239	2,602	-4637
Agriculture	3,488	1,226	-2262
Forestry & Fisheries	3	5	2
Mining	3,748	1,371	-2377
SECONDARY ACTIVITIES	31,389	29,786	-1603
Contract Construction	2,958	3,216	258
Food & Kindred Products	949	1,312	363
Textile Mill Products	310	12	- 298
Apparel	262	154	- 108
Lumber, Wood Products, Furniture	348	164	- 184
Printing & Publishing	610	707	97
Chemicals & Allied Products	849	1,882	1033
Electrical & Other Machinery	825	1,222	397
Motor Vehicles & Equipment	41	8	- 33
Other Transportation Equipt.	9	8	- 1
Other & Miscellaneous	24,228	21,101	-3127
TERTIARY ACTIVITIES	30,252	31,193	941
Transportation & Communica- tions	3,691	2,971	- 720
Utilities & Sanitary Service	1,440	1,519	79
Wholesale Trade	1,877	1,556	- 321
Retail Trade	10,217	9,920	- 297
Finance, Ins. & Real Estate	1,440	1,712	272
Personal Services	4,414	3,994	- 415
Professional Services	5,008	7,119	2111
Recreational Services	519	636	117
Public Administration	1,591	1,727	136
Armed Forces	55	34	- 21
NOT REPORTED	718	2,129	1411

TABLE 11-21
SOCIO-ECONOMIC CHARACTERISTICS
WEST VIRGINIA STATE PLANNING SUB-REGION 17
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1966		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	192,400	Number	194,380	95,307	99,073	5,839	56,483	132,058
Absolute Change 1960-1966	-2,000	Percent						
Percent Change 1960-1966	-1.0	Distribution	100.00	49.05	50.97	3.00	29.06	67.94
		Percent Change 1950-1960	2.30	0.98	3.60	-70.61	31.84	3.73

DISTRIBUTION OF FAMILIES BY INCOME, 1960						
	Under \$2000	\$2000- \$2999	\$3000- \$5999	\$6000- \$9999	\$10,000 & Over	Total
Number	5,487	3,616	17,984	16,935	6,407	50,429
Percent Distribution	10.88	7.17	35.66	33.58	12.70	100.00
Percent Change 1950-1960	-53.44	-66.02	-10.30	354.02	501.60	3.91

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960				
	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	111,518	50,131	47,516	11,825
Percent Distribution	100.00	44.95	42.61	10.60
Percent Change 1950-1960	0.81	-16.95	26.69	28.53

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960							RATE OF UNEMPLOYMENT, 1962-65	
	Total		Male		Female		1962	1963
	Employed	Unem- ployed	Employed	Unem- ployed	Employed	Unem- ployed		
Number	65,676	4,831	46,754	3,508	18,922	1,323	1964	1965
Percent Distribution	93.15	6.85	93.02	6.98	93.45	6.55		
Percent Change 1950-1960	-5.56	55.19	-9.91	44.12	7.22	94.85		

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960							PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT		
	Total		Male		Female		1965	Chng. 1962-65	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	Number	No.	%
Number	70,541	69,189	50,296	17,447	20,245	51,742	Tot. Work Force	73.1	0.7
Percent Distribution	50.48	49.52	74.25	25.75	28.12	71.88	Tot. Employment	69.4	3.2
Percent Change 1950-1960	-2.98	-0.83	-7.49	9.47	10.36	-3.88	Unemployment	3.7	-2.5

Includes persons in the Armed Forces.

State Planning Sub-region 18

This is a major coal mining area which centers on three major towns in northern West Virginia - Morgantown, Fairmont, and Clarksburg. The sub-region is bounded on the north, west, and southwest by those areas focused on Pittsburgh, Pennsylvania, and Parkersburg and Charleston, West Virginia, respectively, and on the southeast by the mountainous rural areas of eastern West Virginia. Although these counties lost a significant part of their population in the period 1950-1965 (down 15 percent for the sub-region), substantial manufacturing employment and the growth of the West Virginia University at Morgantown tend to compensate for the decline in mining. The terrain is somewhat less hilly and less forested than are other areas of West Virginia, and farming is more extensive and generally more prosperous (see Figure 11-29). The sub-region will be well served by interstate and development highways which will link the counties together and provide good access from Pittsburgh and Charleston.

The total population of State Planning Sub-region 18 was about 265,000 in 1965, and total employment about 88,200 workers. A larger share of total employment is engaged in services in State Planning Sub-region 18 than in most other areas of the water sub-region. In 1965, service employment accounted for 55 percent of total employment in Monongahela County (West Virginia University) and manufacturing for about 26.7 percent.

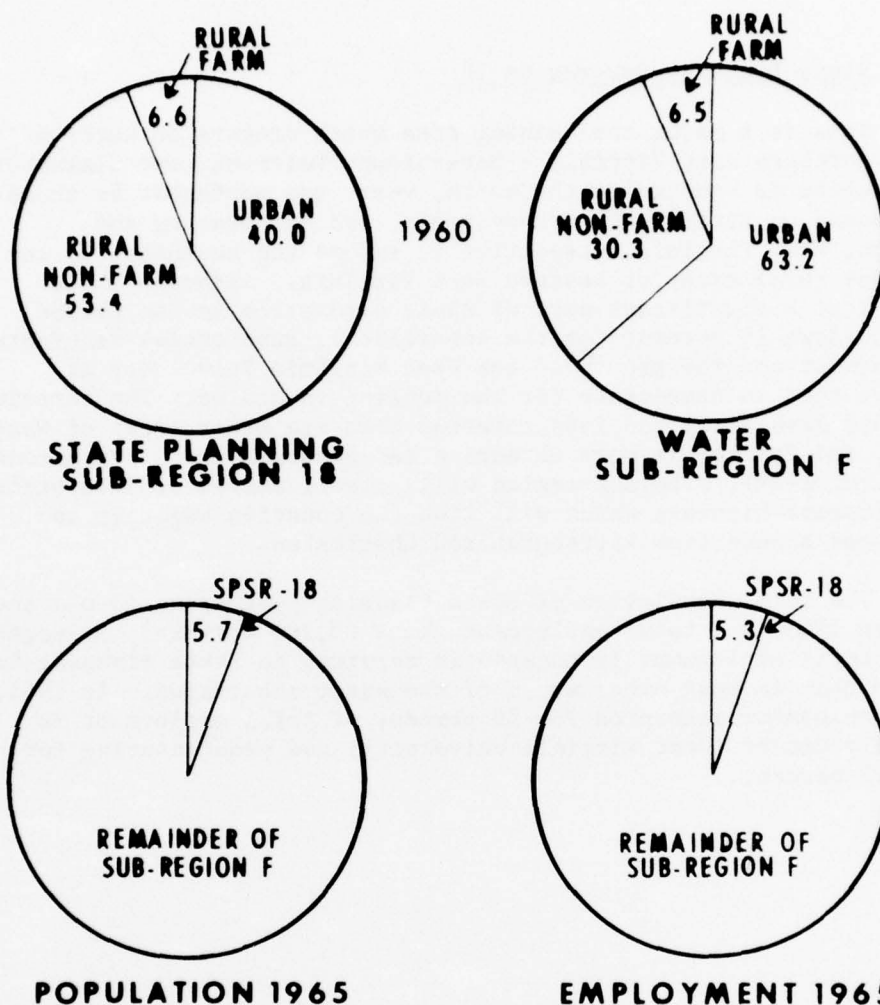


Figure 11-29 - Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 18 Compared to Sub-region F.

While the population of State Planning Sub-region 18 declined during the period 1960-1965, employment remained approximately the same, with increases in manufacturing, for the most part, offsetting losses in mining, trade and services.

Manufacturing, which accounts for roughly 20 percent of employment, is the leading employer. In 1963, value added by manufacture in the region totaled \$148.2 million, or about 8 percent of the total for the state. Glass is the leading manufactured product. Weston, Clarksburg, Fairmont and Morgantown have been noted for years as producers of glass. Other manufactured products include primary metals, fabricated metals, apparel and wood products.

The Monongahela River, which is navigable from Fairmont to Pittsburgh, provides water transportation.

The Monongahela River and West Virginia University, along with Interstate 79, give impetus to strong future growth possibilities in Monongalia and Marion Counties. Interstate 70 and Appalachian Corridor "D" will stimulate growth in the Clarksburg area.

Of the 95.7 thousand persons in the total civilian labor force in State Planning Sub-region 18 in 1965, 6.4 thousand were unemployed. The unemployment rate was 6.7 percent. The number of persons unemployed declined about 20 percent during the period 1960-1965.

Statistical Summary. Statistical data relating to the economy of State Planning Sub-region 18 are given in Tables 11-22 and 11-23.

TABLE 11-22
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
WEST VIRGINIA STATE PLANNING SUB-REGION 18

	<u>1950</u>	<u>1960</u>	<u>Absolute Change</u>
TOTAL ALL SECTORS	99,488	85,061	-14,427
PRIMARY ACTIVITIES	30,375	14,995	-15,380
Agriculture	8,822	3,850	- 4,972
Forestry & Fisheries	16	19	3
Mining	21,537	11,126	-10,411
SECONDARY ACTIVITIES	23,014	21,424	- 1,590
Contract Construction	4,944	4,239	- 705
Food & Kindred Products	919	1,204	285
Textile Mill Products	37	8	- 29
Apparel	645	790	145
Lumber, Wood Products, Furniture	1,310	933	- 377
Printing & Publishing	623	875	252
Chemicals & Allied Products	1,544	126	- 1,418
Electrical & Other Machinery	1,604	3,021	1,417
Motor Vehicles & Equipment	32	21	- 11
Other Transportation Equipt.	14	17	3
Other & Miscellaneous	11,342	10,190	- 1,152
TERTIARY ACTIVITIES	44,494	46,351	1,857
Transportation & Communica- tions	5,858	4,996	- 862
Utilities & Sanitary Service	2,479	2,920	441
Wholesale Trade	2,360	2,158	- 202
Retail Trade	13,421	13,035	- 386
Finance, Ins. & Real Estate	1,551	1,806	255
Personal Services	6,765	6,299	- 466
Professional Services	8,952	11,824	2,872
Recreational Services	656	508	- 148
Public Administration	2,377	2,702	325
Armed Forces	75	103	28
NOT REPORTED	1,605	2,291	686

TABLE 11-23
SOCIO-ECONOMIC CHARACTERISTICS
WEST VIRGINIA STATE PLANNING SUB-REGION 18
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1966		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	266,300	Number	274,164	134,470	139,694	17,862	146,483	109,819
Absolute Change 1960-1966	-7,900	Percent Distribution	100.00	49.05	50.95	6.52	53.43	40.05
Percent Change 1960-1966	-2.9	Percent Change 1950-1960	-10.78	-12.60	-8.95	72.24	15.52	-5.43

DISTRIBUTION OF FAMILIES BY INCOME, 1960						
	Under \$2000	\$2000- \$2999	\$3000- \$5999	\$6000- \$9999	\$10,000 & Over	Total
Number	14,603	7,999	26,134	16,370	5,307	70,413
Percent Distribution	20.74	11.36	37.12	23.25	7.54	100.00
Percent Change 1950-1960	-41.66	-53.62	4.00	317.07	338.59	-6.46

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960				
	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	155,800	74,923	57,271	20,450
Percent Distribution	100.00	48.09	36.76	13.13
Percent Change 1950-1960	-7.38	-19.04	17.85	2.22

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960							RATE OF UNEMPLOYMENT, 1962-65	
	Total	Male		Female			1962	11.0
	Employed	Unem- ployed	Employed	Unem- ployed	Employed	Unem- ployed	1963	8.8
Number	84,958	7,199	59,056	5,843	25,902	1,356	1964	7.5
Percent Distribution	92.19	7.81	91.01	8.99	95.03	4.97	1965	6.4
Percent Change 1950-1960	-14.54	45.49	-22.64	39.32	12.27	79.84		

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960							PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT		
	Total		Male		Female		1965	Chng. 1962-65	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	Number	No.	%
Number	92,260	107,988	64,990	31,734	27,270	76,254	Tot. Work Force	94.3	1.8
Percent Distribution	46.07	53.93	67.19	32.81	26.34	73.66	Tot. Employment	88.2	5.9
Percent Change 1950-1960	-11.66	-10.16	-19.37	2.57	14.40	-14.57	Unemployment	6.1	-4.1
									-59.8

Includes persons in the Armed Forces.

DEVELOPMENT
OF
WATER RESOURCES
IN
APPALACHIA

MAIN REPORT
PART II
SHAPING A PLAN

CHAPTER 12 - SHAPING THE PLAN FOR SUB-REGION F

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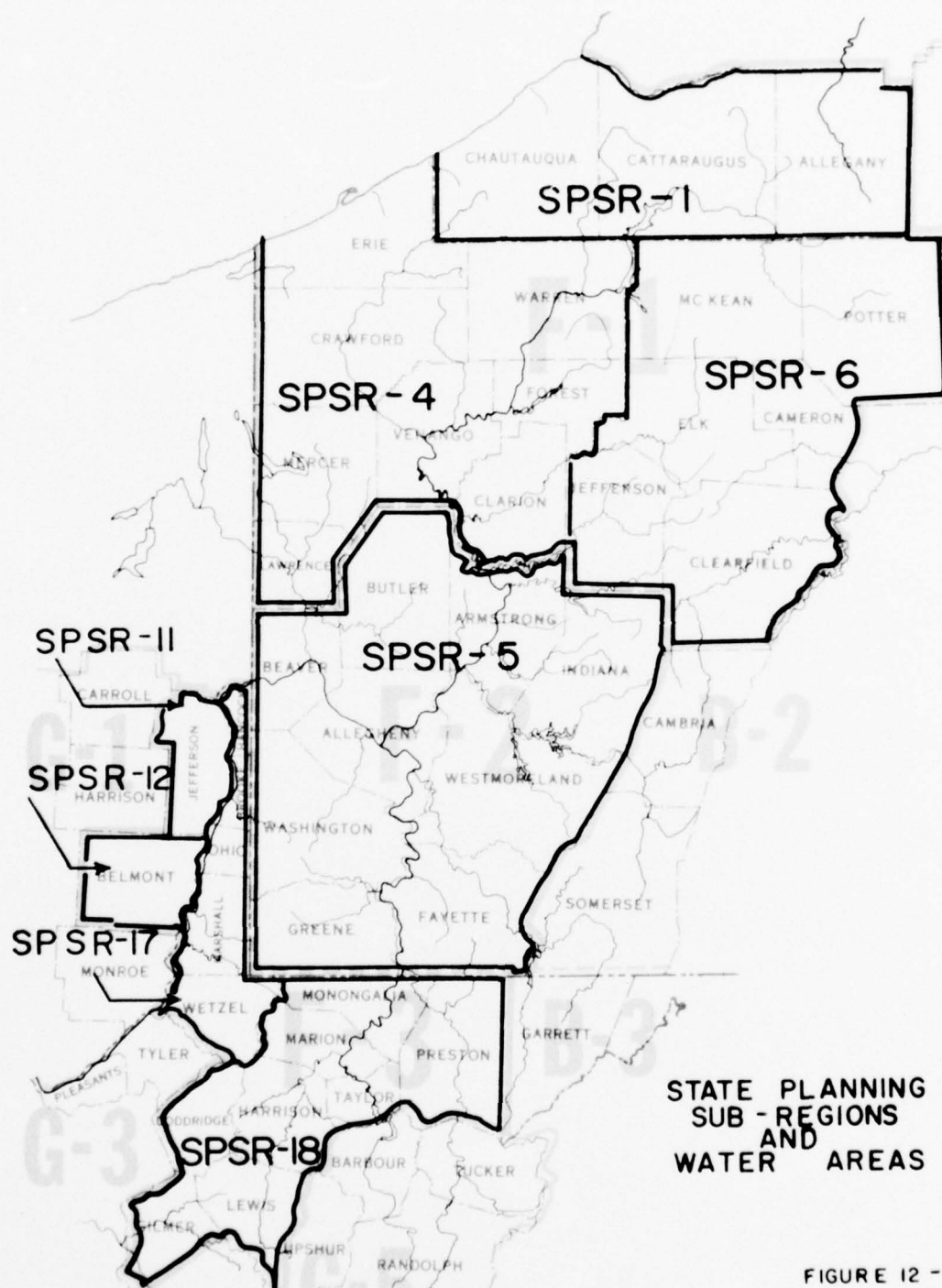


FIGURE 12 - 1

CHAPTER 12 - SHAPING THE PLAN FOR SUB-REGION F

SECTION I - FUTURE GROWTH PATTERNS

1. PREFACE

Planning for the areas of potential growth and future needs of Water Sub-region F (see Figure 12-1) necessitates definition of water related needs. Alternative possibilities to satisfy the water sub-regions needs in Water Areas F-1, F-2, and F-3 are identified. In plan evolution and evaluation care is taken to understand the relationship between water resources and economic development.

The resulting plan provides an effective means to evaluate and understand the needs and resource potentials of the total water sub-region. The plan reflects a balance between the projections of employment and population (benchmarks) and environmental and political (or institutional) constraints. The plan also incorporates consideration of other programs (particularly the Ohio River Basin Comprehensive Survey) that are now in progress.

2. THE WATER SUB-REGION AND WATER AREAS

Population and employment projections for two conditions of the economy are summarized in Table 12-1 for Water Sub-region F and Water Areas F-1, F-2, and F-3. (See also Figure 12-2.)

TABLE 12-1
POPULATION AND EMPLOYMENT

Year	Water Area F-1	Water Area F-2	Water Area F-3	Water Sub-Region F
<u>1960</u>				
Population	1,235,674	2,883,728	651,610	4,771,012
Employment	426,094	975,910	210,000	1,612,004

CONDITION 1 - PROJECTED POPULATION AND DEVELOPMENT */

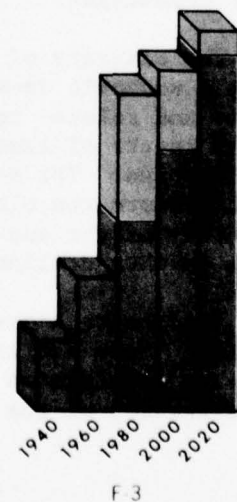
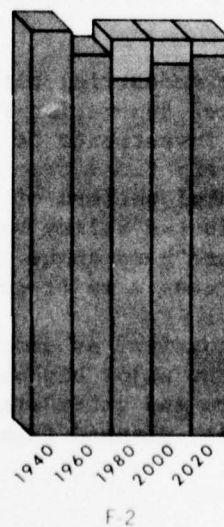
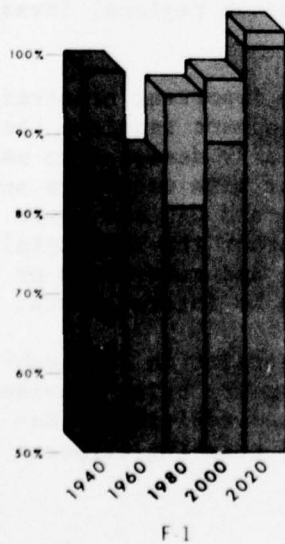
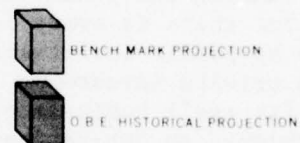
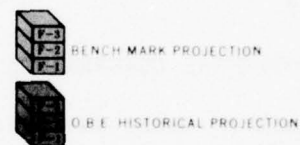
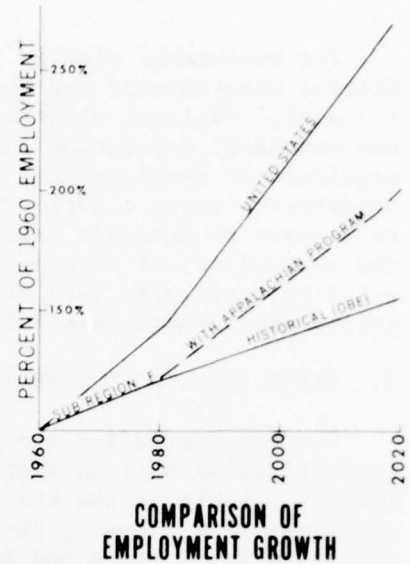
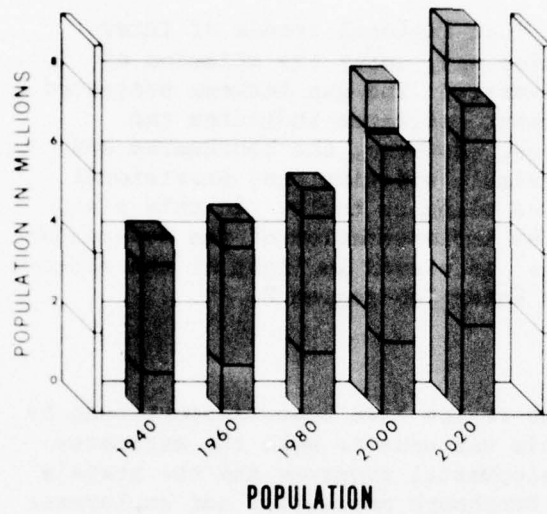
<u>1980</u>				
Population	1,491,000	3,439,000	726,000	5,656,000
Employment	522,000	1,184,000	245,000	1,951,000
<u>2000</u>				
Population	1,813,000	4,014,000	818,000	6,645,000
Employment	635,000	1,397,000	282,000	2,314,000
<u>2020</u>				
Population	2,174,000	4,602,000	922,000	7,698,000
Employment	763,000	1,634,000	326,000	2,723,000

CONDITION 2 - ACCELERATED POPULATION AND EMPLOYMENT */ BENCHMARKS

<u>1980</u>				
Population	1,491,000	3,439,000	726,000	5,656,000
Employment	550,000 **/	1,184,000	245,000	1,979,000
<u>2000</u>				
Population	2,243,000	4,450,000	850,000	7,543,000
Employment	846,000	1,530,000	310,000	2,686,000
<u>2020</u>				
Population	2,970,000	5,383,000	975,000	9,328,000
Employment	1,151,000	1,967,000	350,000	3,468,000

*/ See Appendix E of the AWRS for projections, assumptions and definitions.

**/ From developmental programs other than water resources.



PER CAPITA INCOME AS PERCENT OF NATIONAL LEVEL

The benchmarks clearly indicate that regional trends of intermittent unemployment and out-migration may, under the stimulus of successful regional planning, be reversed. The gap between projected and benchmark population and employment estimates indicates the magnitude of developmental objectives. However, the benchmarks and projections require periodic reappraisal, updating, and provisional adjustment to maintain their value as planning tools. In this plan, the possibility of closing the gap by implementation of the sub-region water resource plan (and other plans) is viewed in light of the alternative development possibilities in Water Sub-region F.

3. STATE PLANNING SUB-REGIONS

The benchmarks for the water sub-region have been reapportioned by state planning unit boundaries. This was done to make the estimates readily useable in the state's developmental programs and the state's water resource planning programs. Benchmark population and employment levels by Water Areas and State Planning Sub-regions are shown in Table 12-2.

4. DEVELOPMENTAL CONSTRAINTS

The lack of water resource development prior to 1936 was one of the identifiable major constraints on the economy. Further, local toleration of floods hindered improvements of areas and economies already hopelessly obsolescent, including what is now the Golden Triangle of Pittsburgh.

Sufficient capital is generally available for investment opportunities, from the banking and credit systems, for the development of the projected economy, but there is every indication that this capital requires supplementation by public investments. Public investment should be placed to stimulate private investment, possibly by creating investment opportunities for small business opportunities throughout the sub-region. This can be achieved in Sub-region F by promoting its unique regional investment advantages.

The scarcity of land for industrial sites is an important constraint to the economic development of Sub-region F. Development requires that water and related resources investments be specifically designed to make large tracts of land relatively flood free along the main waterways and tributaries. The developmental pattern of interspersed old and newer parts; where the old parts in the valley bottoms harbor the industrial capacity of the sub-region and need to be renovated and modernized or face further decline constitutes a major constraint to future growth.

Inadequate access is recognized as another constraint in this sub-region. Many additions to the major highway systems are being provided, through Appalachian Corridors and other state-planned additions. Revitalization of the railroads, planned expansion of existing airports and

TABLE 12-2
DEVELOPMENTAL BENCHMARKS
BY WATER AREA AND STATE PLANNING SUB-REGION

Area	1960 (For Comparison)	<u>YEARS</u>		
		1980	2000	2020
<u>WATER AREA F-1</u>				
SPSR-1				
Population	269,542	325,000	489,000	647,000
Employment	97,456	130,000	184,000	251,000
SPSR-4				
Population	721,892	871,000	1,310,000	1,734,000
Employment	246,736	310,000	494,000	672,000
SPSR-6				
Population	1,235,674	1,491,000	2,243,000	2,970,000
Employment	425,651	550,000	846,000	1,151,000
<u>WATER AREA F-2</u>				
SPSR-5				
Population	2,883,728	2,400,000	4,450,000	5,383,000
Employment	974,009	1,184,000	1,561,000	1,969,000
<u>WATER AREA F-3</u>				
SPSR-17*/				
Population	377,455	402,100	438,300	505,200
Employment	124,918	132,400	146,100	175,000
SPSR-18				
Population	651,619	726,100	850,300	975,200
Employment	84,958	113,000	164,000	175,000

*/ Two Ohio Counties, not in SPSR-17 (Jefferson County in SPSR-11 and Belmont County in SPSR-12) are in Water Sub-region F and the projections for these counties are included with SPSR-17.

airline facilities, and establishment of new airports is expected to remove some of this constraint, as is the inland waterway system modernization program. Improvements and expansions of all these facilities are needed to achieve the growth possibilities represented in the developmental benchmarks.

Additional highway access investments, placing present and future sub-region recreational developments within short driving time of many metropolitan areas in and surrounding the sub-region, would remove important environmental constraints to development. Investments in human resources are of particular importance to manufacturing employment centers in the sub-region. Analysis of areas where potential employment growth appears to be most likely indicates that each state must provide the infrastructure, satisfy environmental needs, and investment in human capital to accomplish this purpose.

Conservation of resources has not generally been considered a serious problem until recently. However, Pennsylvania has had active programs for many years. As land use has increased, resources have not been carefully managed for multiple-purpose use. This now necessitates mineral conservation and erosion control, mine area restoration, an extensive program of acid mine drainage abatement and water quality control throughout the sub-region so that the projected economy will not be constrained by prior ill use of the area's natural resources.

The land use pattern in Sub-region F constrains efficient utilization of the workforce and resources of the area. There is much agricultural land that is not used effectively. Some of this will be consumed by urban sprawl. Throughout the sub-region, areas of terrible congestion exist near vast relatively unused areas. The sub-region needs a land classification inventory and land-use plan.

A final constraint to economic development is the limited planning capabilities of the individual counties. Their efforts require larger staff and more coordinated management to accomplish the planning coordination goal.

5. PATTERNS OF GROWTH ANTICIPATED

This part of the chapter describes potential growth patterns, based upon removal of economic deterrents. This description uses the benchmarks, for the sub-region and its state planning units, in estimating the area's water related needs, and in describing ways and means of achieving sub-regional and state planning unit growth potentials.

While agriculture, mining, petroleum, primary metals and transportation will remain important sectors, growth and diversification must come in other sectors, most probably in fabricated metals, machinery, chemical and in trade and services.

The following broad pattern of growth is likely: between Pittsburgh and Youngstown in Beaver, Butler, Lawrence and Mercer Counties, opportunities for economic growth appear favorable. Economic prospects are good in Erie County, Pennsylvania, and Chautauqua and Cattaraugus Counties of New York State. In the area from Wheeling to Parkersburg, in Hancock, Brooke, Ohio, Marshall and Wetzel Counties in West Virginia, and the area south of Pittsburgh, in Washington and Westmoreland Counties of Pennsylvania, growth is anticipated.

Other areas with growth potential are scattered. They include the Indiana, DuBois-Clearfield and Ridgway-St. Marys areas, Clarion, Punxsutawney, Emporium and Coudersport. The principle growth area in the southern portion of the sub-region centers on the Clarksburg-Fairmont-Morgantown area. See Figure 12-3 for location of growth areas.

To summarize by states: For Pennsylvania, */ two of three major urban complexes in Appalachia are centered on Pittsburgh and Erie in Water Areas F-1 and F-2. The largest, the Pittsburgh urban belt, extends from Fayette County through Beaver County to Youngstown, Ohio. Secondary nuclei are located at New Castle and the Sharon-Farrel urban areas which form links in the Pittsburgh-Youngstown steel manufacturing urban belt. Significant are the urban areas of Johnstown and Altoona in Water Area B-2, which border the Pittsburgh urban complex on the east.

For New York, **/ in Water Area F-1, there is growth potential along the Southern Tier of counties connecting the Erie urban complex on the west (projected to become a continuum from the eastern megalopolis) to the western megalopolis bordering the Great Lakes. Other potential growth nuclei extend along the shore of Lake Erie, from Buffalo to Cleveland. There is a scattering of nuclei in New York counties of Chautauqua, Cattaraugus, Allegheny in Water Area F-1, including centers at Hornell-Wellsville, Olean-Bradford, Jamestown-Warren, and Dunkirk, Gowanda and Franklinville.

State designated potential growth areas of West Virginia***/ are all located in Water Area F-3. These nuclei include an industrial urban complex bordering the Ohio River, the Wheeling, Steubenville, Weirton SMSAs, and Morgantown-Fairmont-Clarksburg urban areas. Other potential growth nuclei are Salem, Weston, Grafton, and Kingwood.

*/ Pennsylvania State Supplement.

**/ New York State Supplement.

***/ West Virginia State Supplement.

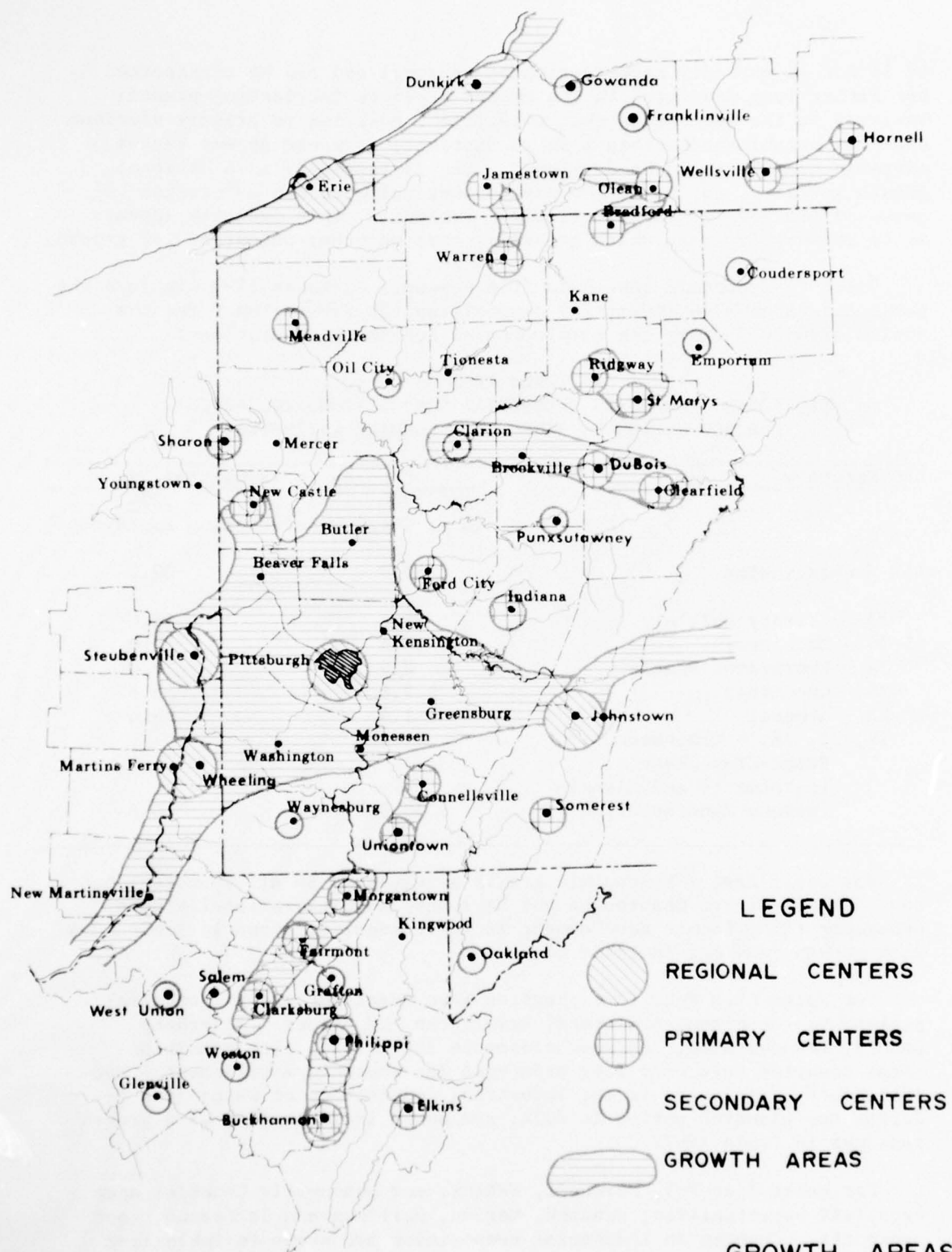
The potential industrial patterns of Sub-region F have been estimated, taking into account the growth needed to reach the developmental benchmarks. The present structure of the economy serves as a basis for appraising the future economy. In the Pittsburgh area primary metals (SIC 33), fabricated metals (SIC 34), and machinery and electrical machinery (SIC 35 and 36) account for about 70 percent of total manufacturing. In the Erie area rubber and plastics (SIC 30), primary metals (SIC 33), fabricated metals (SIC 34), and machinery and electrical machinery (SIC 35 and 36) account for most manufacturing. Many of the smaller industrial centers have a similar industrial mix, particularly in Water Areas F-2 and F-3.

Water-oriented industries in Water Area F-1 constitute about 26 percent of total manufacturing, with primary metals accounting for about 50 percent of this, and about 14 percent of the industrial mix; in Water Area F-2 they constitute about 55 percent of total manufacturing with primary metals accounting for about 78 percent of this, and about 42 percent of the industrial mix; and in Water Area F-3 about 55 percent of total manufacturing, with primary metals accounting for about 80 percent of this, and about 44 percent of the industrial mix. Chemicals have percentages as follows: Water Area F-1, 8 percent (of water-oriented industries), and 2 percent (of industrial mix); in Water Area F-2, 6 percent, and 3 percent; and in Water Area F-3, 6 percent and 4 percent.

The Future Industrial Mix

Projections of industrial mix indicate that for the sub-region as a whole, decreasing primary metals manufacturing employment will continue until a diversified and stable industrial base is achieved. Accelerated economic development requires modification of the available industrial mix to compensate for the primary metals decline by increasing the industrial sectors which enjoy national growth; namely, SIC 34 (fabricated metals), SIC 35 and 36 (machinery); SIC 23 (apparel), and SIC 28 (chemicals). The principal opportunities appear to be for increasing SIC 34 in those areas where SIC 33 is predominant.

Analysis of growth potential indicates that where SIC 33 (primary metals) is sizeable, but employment is decreasing (although gross tonnage and income flows will probably increase), and where SIC 34 is already an established part of the industrial mix, this industry will become more important. Secondly, as a strategy, it would be advantageous to increase SIC 35-36 by expanding the present base, particularly where there is substantial employment now. Third, SIC 28, which has gained a foot-hold in the sub-region, has potential because of land, water supply, cheap power, and navigable waters availability. The aluminum portion of SIC 33 has needs similar to SIC 28 and has growth possibilities in the same areas. The aluminum industry is limited only by the availability of sites along navigable streams and cheap electrical power.



It is not so markedly market-oriented as steel and can be transported for rather long distances in the molten state to fabricating plants. Wherever in the sub-region that satellite industries to primary aluminum could be established within a short distance, it would appear that a sizeable complex could be developed. SIC 23 (apparel) is a national growth industry, but is of low development value to the sub-region because of its low-pay characteristic. Presently, this industry appears to be growing in areas which generally have no other potential for growth.

Using the economic base data from Appendix E, Table 12-3 displays the projected changes in industrial composition for Sub-region F for the period 1960-2020 under the developmental benchmark assumptions:

TABLE 12-3
PROJECTED CHANGES IN INDUSTRIAL COMPOSITION, 1960-2020
FOR SUB-REGION F, BASED ON BENCHMARK ESTIMATES

SIC Category	Changes in Industrial Mix	
	1960	2020
	(% of Total Manufacturing Employment)	
All Manufacturing	37.7	32.0
33 - Primary Metals	34.3	18.0
35-36 - Machinery	17.4	27.0
34 - Fabricated Metals	8.9	18.0
28 - Chemicals	2.8	6.8
23 - Apparel	1.4	5.4
19, 32, 38, - Ordinance, Stone-Clay-Glass, Instruments and Miscel- laneous Manufacturing	10.5	6.8

For Water Area F-1 economic growth is expected in all counties; but four (Erie, Mercer, Chautauqua and Lawrence) have exceptionally good prospects for economic development in the categories shown in Table 12-4 with growth rankings in Table 12-5.

For Water Area F-2, five counties have excellent growth potential; Butler, Westmoreland, Armstrong, Washington and Beaver. Allegheny County, Pennsylvania, has good prospects for growth. The remaining three counties have only fair prospects for economic development. Modifications anticipated in the industrial composition of Water Area F-2 during the planning period to 2020, are shown in Table 12-6 with growth rankings in Table 12-7.

For Water Area F-3, Marshall, Wetzel, and Monongalia Counties have excellent opportunities; Hancock, Marion, Harrison and Jefferson, good prospects. Changes in industrial composition are shown in Table 12-8 with growth rankings in Table 12-9.

TABLE 12-4
PROJECTED CHANGES IN INDUSTRIAL COMPOSITION, 1960-2020
FOR WATER AREA F-1, BASED ON DEVELOPMENTAL BENCHMARK ESTIMATES

SIC Category	Changes in Industrial Mix	
	1960	2020
	(% of Total Manufacturing Employment)	
All Manufacturing	39.7	31.7
33 - Primary Metals	13.6	11.0
35-36 - Machinery	25.8	21.9
34 - Fabricated Metals	10.8	12.0
28 - Chemicals	1.9	2.2
23 - Apparel	1.6	9.6
24-25 - Lumber & Wood Products, Furniture & Fixtures	7.9	9.6
32 - Stone, Clay & Glass	8.2	4.1

TABLE 12-5
RATING OF POTENTIAL GROWTH POSSIBILITIES OF
WATER AREA F-1 COUNTIES

County	Potential	Growth Centers
1. Erie	Excellent	Erie
2. Mercer	Excellent	Sharon, Farrell
3. Chautauqua	Excellent	Dunkirk, Jamestown
4. Lawrence	Excellent	New Castle, Ellwood City
5. Cattaraugus	Good	Olean, Salamanca
6. Crawford	Good	Meadville
7. Venango	Good	Franklin, Oil City
8. Allegany	Good	Wellsville
9. Clarion	Average	Clarion
10. Warren	Average	Warren
11. Jefferson	Average	Punxsutawney
12. Clearfield	Average	DuBois, Clearfield
13. McKean	Fair	Bradford
14. Elk	Fair	Ridgeway, St. Marys
15. Potter	Fair	Coudersport
16. Cameron	Fair	Emporium
17. Forest	Fair	NONE

TABLE 12-6
PROJECTED CHANGES IN INDUSTRIAL COMPOSITION, 1960-2020
FOR WATER AREA F-2, BASED ON DEVELOPMENTAL BENCHMARK ESTIMATES

SIC Category	Changes in Industrial Mix	
	1960	2020
	(% of Total Manufacturing Employment)	
Manufacturing	37.0	31.8
23 - Apparel	1.3	1.4
28 - Chemicals	3.0	8.3
33 - Primary Metals	42.3	21.9
34 - Fabricated Metals	8.3	21.9
35-36 - Machinery	15.5	30.4
32 - Stone, Clay & Glass	9.9	7.2

TABLE 12-7
RATING OF POTENTIAL GROWTH POSSIBILITIES OF
WATER AREA F-2 COUNTIES

County	Potential	Growth Centers
1. Butler	Excellent	Butler
2. Westmoreland	Excellent	Jeannette, Greensburg
3. Armstrong	Excellent	Kittanning, Ford City
4. Washington	Excellent	Washington, Canonsburg
5. Beaver	Excellent	Beaver Falls, Aliquippa
6. Allegheny	Good	Pittsburgh
7. Indiana	Average	Indiana
8. Fayette	Fair	Uniontown, Connellsville
9. Greene	Fair	Waynesburg

TABLE 12-8
PROJECTED CHANGES IN INDUSTRIAL COMPOSITION, 1960-2020
FOR WATER AREA F-3, BASED ON DEVELOPMENTAL BENCHMARK ESTIMATES

SIC Category	Changes in Industrial Mix	
	1960	2020
	(% of Total Manufacturing Employment)	
Manufacturing	31.6	34.3
33 - Primary Metals	43.6	19.3
35-36 - Machinery	6.3	25.0
34 - Fabricated Metals	7.9	15.8
28 - Chemicals	3.5	12.5
23 - Apparel	2.1	13.3
32 - Stone, Clay & Glass	19.4	12.5

TABLE 12-9
RATING OF POTENTIAL GROWTH POSSIBILITIES OF
WATER AREA F-3 COUNTIES

County	Potential	Growth Centers
1. Marshall	Excellent	Moundsville
2. Wetzel	Excellent	New Martinsville
3. Monongalia	Excellent	Morgantown
4. Hancock	Good	Weirton
5. Marion	Good	Fairmont
6. Harrison	Good	Clarksburg
7. Jefferson	Good	Steubenville
8. Belmont	Good	St. Clairsville
		Martins Ferry
		Bellaire
9. Ohio	Fair to Good	Wheeling
10. Brooke	Fair to Good	Wellsburg
11. Taylor	Fair	Grafton
12. Lewis	Fair	Weston
13. Doddridge	Average	West Union
14. Preston	Average	Kingwood
15. Gilmer	Poor	Glenville

SECTION II - WATER NEEDS RELATED TO FUTURE GROWTH

6. DEVELOPMENT CONSIDERATIONS

The sub-region's economy has been dependent upon water-using industries, mainly the primary metals group, particularly steel. These industries remain essential but can now be augmented by a wide range of other industries due to scientific, technological, and environmental changes affecting opportunities for sub-regional economic enhancement. With diversification of the industrial base, new water and related resources investments are needed to reach projected (benchmark) economic potential. These investments require a comprehensive water plan.

Plan formulation recognized the following sub-regional water resource characteristics: (1) Most industrial and community water supplies come from major rivers, reservoirs, and lake impoundments, so there is no general water supply problem, although local difficulties and economic development strategies will require new water control and supply structures, (2) good quality water is not widespread in the sub-region particularly in the Monongahela River and lower Allegheny River valleys and in many tributary streams, (3) water withdrawal particularly for industrial cooling, is very great and will increase, (4) flood damages persist in varying degrees throughout the sub-region, limiting economic potential in the flood plain areas where developable land is needed for industrial purposes, (5) multiple-purpose water resource investments, especially for recreation, must be increased to satisfy tremendous metropolitan-area recreation demand, (6) attention must be focused on protecting, enhancing and rehabilitating high economic development potential upstream areas, and (7) environmental problems have developed from urbanization; the small supply of available land is in danger of being ineffectively consumed or of having its usefulness destroyed without regard to its optimum value. Important ecological factors must receive prime attention in analyzing land and water requirements to achieve recreation, aesthetic, preservation, conservation, beautification and urban design goals.

7. GENERAL SURVEY OF NEEDS

Aid in the identification and definition of water needs has been obtained from local and state planners, from information in the State Water Supplements and the State Investment Plans, and from states' requests for projects found most desirable for economic development purposes. For the most part, planners of the sub-region are cognizant of the demands and possible conflicts which further development of this resource can engender. Consequently, most needs have been analyzed comprehensively with political, socio-economic and physical aspects considered. The scoping of needs reflects the benchmarks. Figure 12-4 provides a visual accounting of the generalized need areas.

Overall sub-region needs take into account the benchmark degree of development. These needs, based on population and employment estimates under stimulated economic development conditions are presented in Tables 12-21 through 12-24 at the end of this section. The overall framework plan in Section IV includes as a base for planning the supply to be furnished by 1980. This appraisal, however, does go beyond the more generalized framework studies covering wider areas of the Ohio River and adjacent basins.*/

General Problem Areas

Water and related resource needs of the sub-region are: pollution abatement, water supply, water quality, navigation, recreation development (including fish and wildlife), recreation enhancement, water damage prevention, low-flow augmentation, hydroelectric power, port improvement, land use and development, sediment control, bank stabilization, conservation, modification of the existing water resource base, preservation of scenic beauty and modification of already authorized or constructed projects. (See Figure 12-4.) The degree to which these needs can be measured and met by water resource investments has influenced preliminary formulation and justification of projects in the water areas, time phased for benchmark achievement. Definition of needs and growth implications, preferably for the long term, hinges on the states' designation of potential growth areas and the nuclei about which growth is predicted.

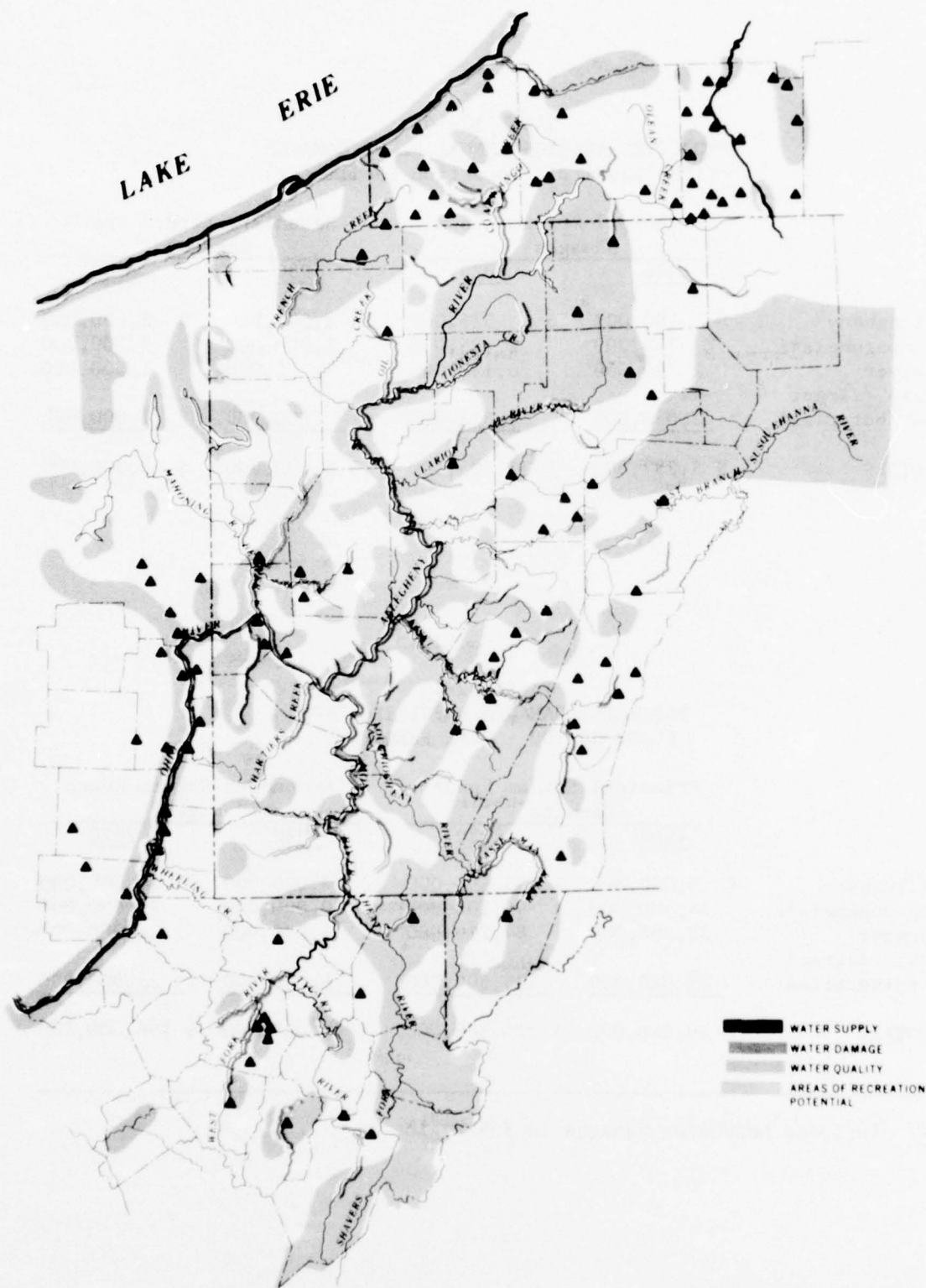
Water Damage Prevention

Sub-regional

Although substantial Federal, state, and local agency water damage prevention programs have steadily been implemented, some urban and industrialized sub-region areas still experience major flood problems. Pennsylvania's State Water Supplement cites 45 communities, of 2,500 or more population, which are subject to major floods; 24 of these are in Sub-region F at growth center locations. The average annual flood damages in the Ohio River Basin portion of the sub-region (which constitutes the major damage evaluated herein) is still almost \$12.1 million. This amount can be expected to increase due to expansions in the partially protected flood plain. Expansions will remain in the flood plain because of advantages, and in many cases the necessity, of being located on or near water.

Tables 12-10 and 12-11 indicate projected water damages for both average annual and 100-year frequency floods. Damages have been

*/ Ohio River Basin Comprehensive Review.



**WATER AND RELATED
RESOURCE PROBLEM AREAS**

TABLE 12-10
PROJECTED AVERAGE ANNUAL FLOOD DAMAGES
(1980 Level of Protection Facilities)

	Principal Stream Reach Damages		Secondary Stream Reach Damages	
	<u>1980</u>	<u>2020</u>	<u>1980</u>	<u>2020</u>
Allegheny	\$ 180,000	\$ 576,000	\$ 1,000,000	\$ 2,500,000
Monongahela*/	719,000	2,125,000	3,000,000	7,500,000
Beaver	2,360,000	6,190,000	700,000	1,500,000
Ohio (direct tributaries)	<u>2,038,000</u>	<u>4,812,000</u>	<u>800,000</u>	<u>1,800,000</u>
TOTALS	\$ 5,297,000	\$ 13,703,000	\$ 5,600,000	\$ 13,300,000

TABLE 12-11
PROJECTED DAMAGES RESULTING FROM
FLOOD OF 100 - YEAR FREQUENCY

	Principal Stream Reach Damages		Secondary Stream Reach Damages	
	<u>1980</u>	<u>2020</u>	<u>1980</u>	<u>2020</u>
Allegheny	\$ 6,080,000	\$ 55,890,000	\$ 17,000,000	\$ 40,000,000
Monongahela*/	24,400,000	99,200,000	30,000,000	75,000,000
Beaver	32,300,000	84,710,000	11,000,000	26,000,000
Ohio (direct tributaries)	<u>37,060,000</u>	<u>135,500,000</u>	<u>6,000,000</u>	<u>15,000,000</u>
TOTALS	\$ 99,840,000	\$ 375,300,000	\$ 64,000,000	\$ 156,000,000

*/ Includes headwater damages in Sub-region G

segregated into principal and secondary stream reaches, the limits of which are shown in Figure 12-5. Figure 12-6 presents water damages graphically, and Figure 12-7 indicates the area that would be inundated by a 100-year flood.

The projected damages above are based on projected development without stimulation. Obviously, if protection is not provided to growth centers throughout the sub-region, the continuing threat of damage will inhibit accelerated growth.

Availability of water, water transportation, abundant electric power, coal and the many other resources in the areas bordering on the Ohio River could entice new industry if the remaining flood hazard were minimized. In the Pittsburgh area, site development, appropriate to manufacturing use, is critical along the Allegheny, Monongahela, Beaver, Youghiogheny, and Kiskiminetas Rivers. Connoquenessing, Chartiers, and Raccoon Creek Valleys have need for protection of potential general manufacturing areas. Areas in the southern tier counties of New York, in the Lake Erie area, also harbor urbanization potentials if flood protection would be provided.

It is essential that flood plain management studies be made to encourage systematic growth without increasing the flood damages or limiting development on good quality land. However, a conflict could arise between competitive potential land uses where industrial land is scarce and where local interests might desire recreational and open-space reservations without first considering growth alternatives.

Watershed districts have already been organized in some areas of the sub-region to provide water damage prevention with other needed programs, and applications for district designation are pending in other areas.

Water Area F-1. Protective works have been planned and installed at many of the growth points. Others are being provided to reduce local flooding and to enhance area growth potential; however, a variety of flooding problems remain, particularly in the Lake Chautauqua-Jamestown area. The local communities and the State of New York have experienced myriad problems (high and low lake levels, pollution in the lake area which has damaged the recreation income with associated problems of high and low stages, water supply and pollution in the Chadakoin River at Jamestown and downstream) which have been detrimental to growth.

Existing industry and recreational facilities on the Lake and industrial sites along the Chadakoin River and Conewango Creek require protection against local flooding. Regulation of flood plain land use is needed because of the conflict between Lake and river

interests. A strong and aggressive approach by New York State to resolve this situation will advance this growth center in the area's economy.

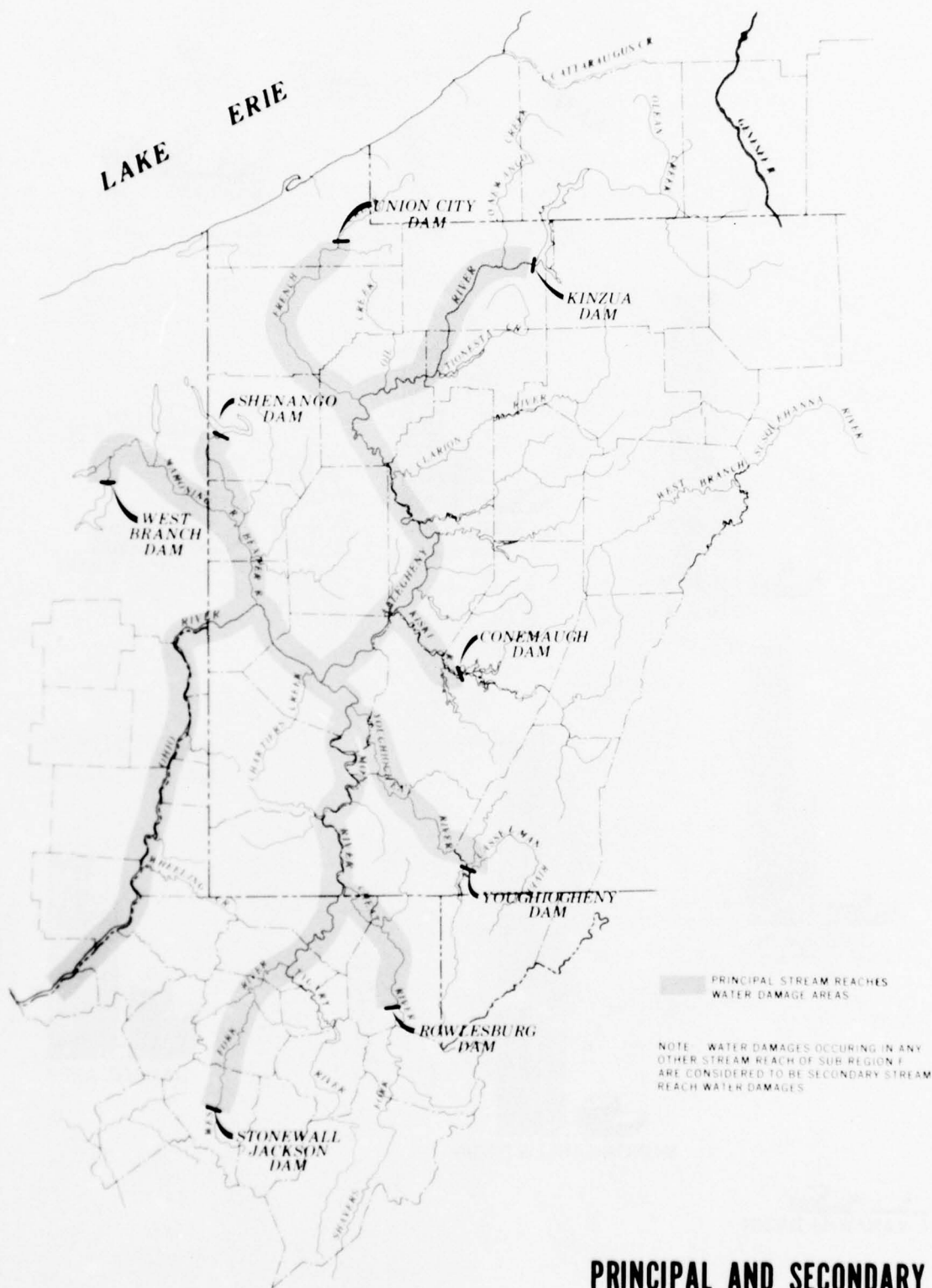
The lower end of Conewango Creek floods Russell, North Warren and Warren, restricting commercial growth and use of sites for machinery manufacturing. Potential growth points in Brokenstraw Creek Valley, as at Youngsville near its mouth and Irvine, may require protection for expansion of residential, commercial, industrial and recreation facilities. The National Forge industrial complex could expand into the protected flood plain between the creek and the Pennsylvania Railroad at Irvine.

Growth possibilities require reassessment of the protection provided on Tunungwant Creek at Bradford, Pennsylvania to foster growth in the upstream and downstream flood plain areas. At Olean, New York, growth may necessitate controlled use of existing ponding areas, which are presently reserved. Possibly some development could be induced behind the pending dike protection project at Salamanca, New York. DuBois, Pennsylvania, near a suggested potential site of a new city, has an economic development base within a presently considered channel improvement reach, as well as developable land in upstream and downstream areas where highway and railroad facilities exist. Growth potential could be enhanced in these reaches by extended channel improvement. The central core of DuBois in the Beaver Run area could expand its manufacturing potential if adequately protected against local flooding from the Run.

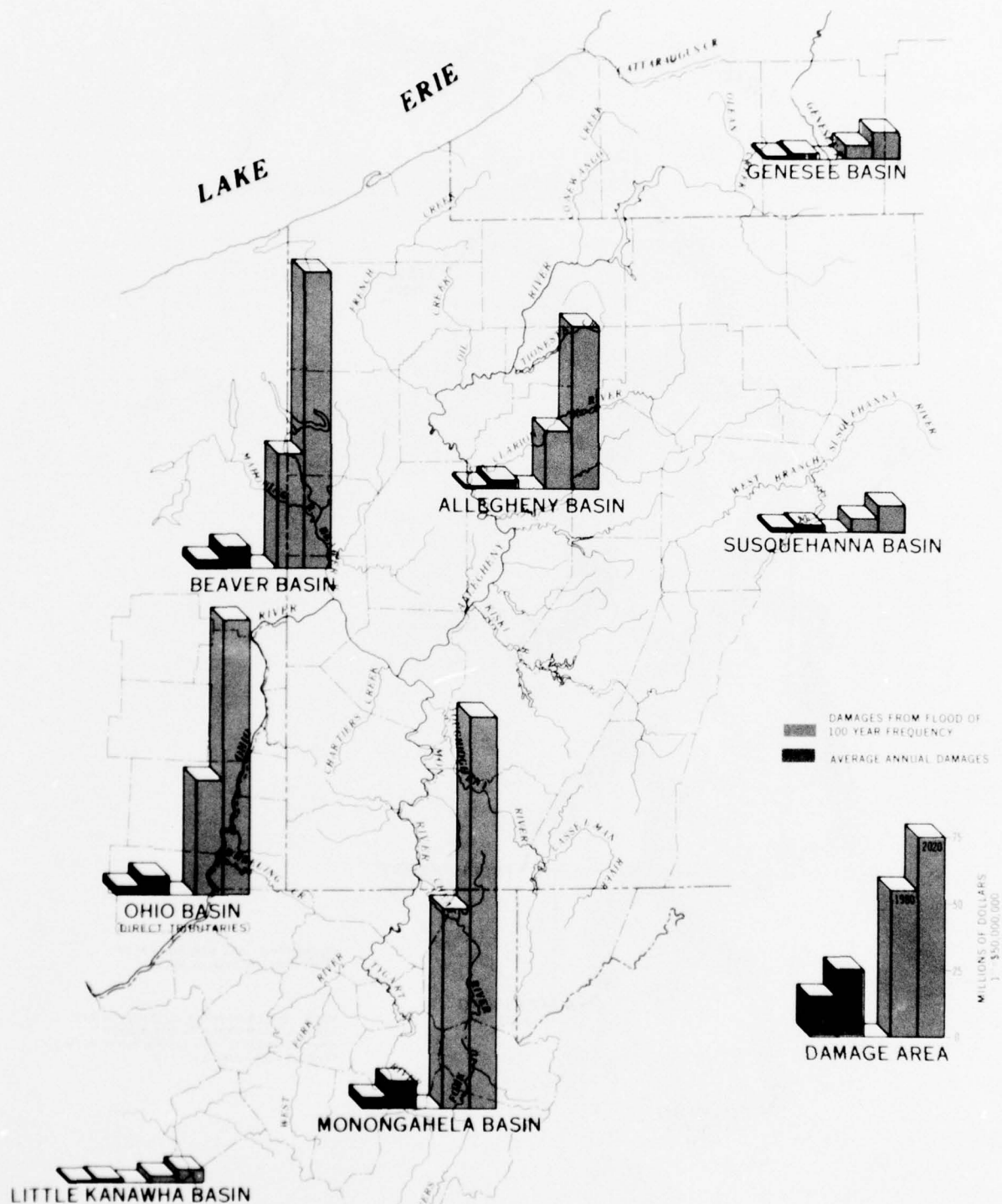
The Greenville, Pennsylvania area, which presently has a partially completed watershed protection project, requires additional works for protection of its railroad facilities and developable flood plain. Titusville has need for protection from Oil Creek flooding of industrial plants and tourist developments around the first oil well drilled by Edwin L. Drake in 1859. Brookville, which now has a completed channel improvement and is traversed by the Keystone Shortway (Interstate Route 80), may soon need extension of this project if industrial and recreational activity is stimulated, offsetting the decline in its electronic industry (radio tubes and transistors), and possible expansion of its railroad equipment manufacturing plant.

New Castle receives local flooding from Neshannock Creek. Railroad and machinery manufacturing plants require flood protection for future expansion.

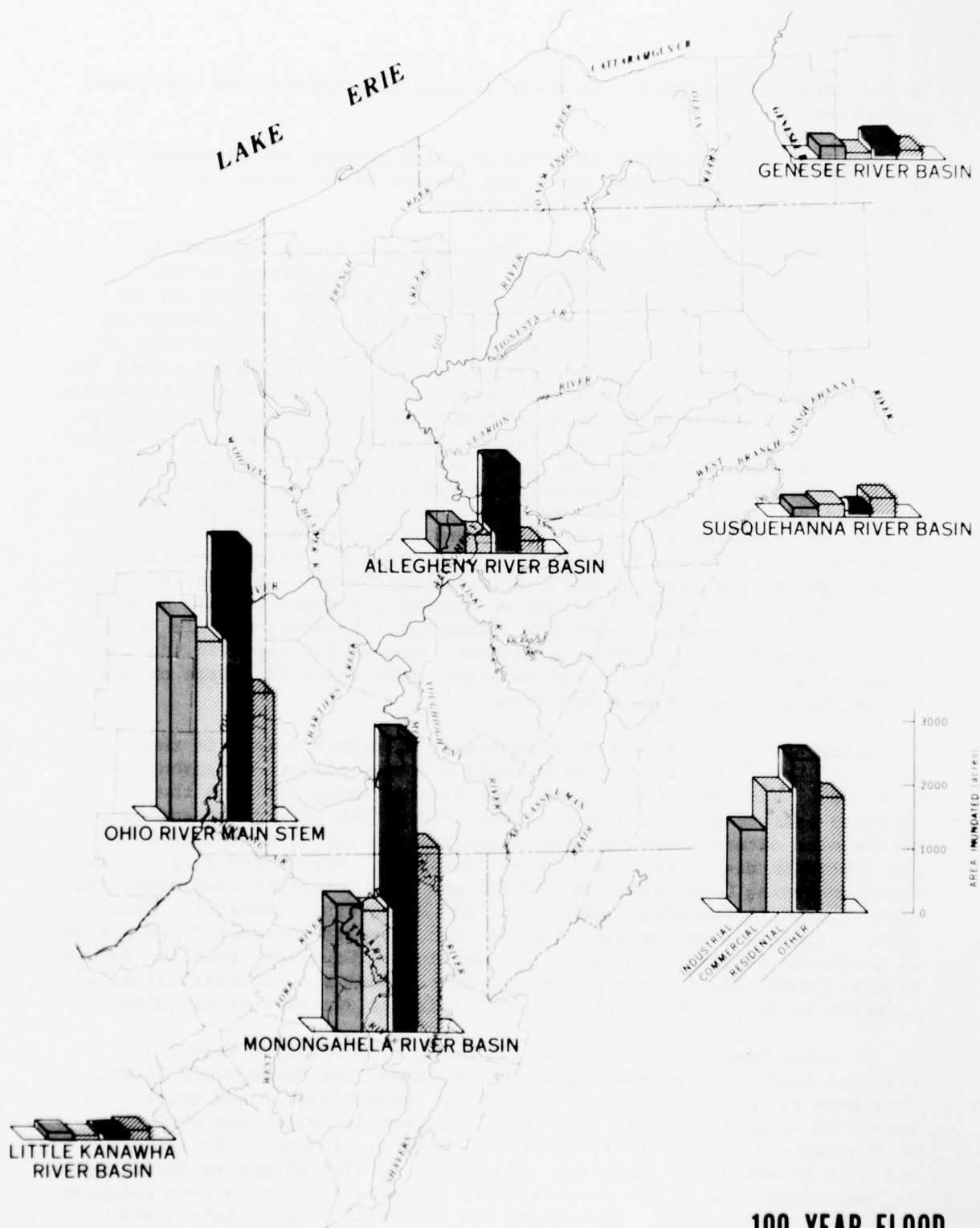
Flood protection works are needed in the LeBoeuf Creek watershed near Erie, Pennsylvania and in the upper French Creek watershed. The Potatoe and Oswago Creek watersheds have upstream flood problems, as do the upper Allegheny River (Potter County), Mahoning Creek, Sandy Lick Creek, and the Tionesta Creek watersheds. Meadville will not be fully protected by the Woodcock, Union City and Muddy Creek Reservoirs



**PRINCIPAL AND SECONDARY
STREAM REACHES**



**PROJECTED WATER DAMAGES
WITHOUT ADDITIONAL PROTECTION**



in the French Creek Basin. Residual damages will necessitate additional protection.

Flooding problems exist in north-draining streams (at Conneautville, Pa.) and, in the Cattaraugus Creek and Genesee River basins, at the extreme northern section of the sub-region.

Water Area F-2. The existing reservoir system designed to alleviate flooding at Pittsburgh and downstream communities on the Ohio River has been instrumental in sustaining economic growth in the area. The program of needed control is not completed. The Rowlesburg Reservoir on the Cheat River in Water Area F-3 will be an effective addition. The residual damage to existing development indicates a need for further development of the system. More extensive developments are anticipated farther upstream into the Allegheny and Monongahela River Valleys and downstream in the Ohio River Valley. Additional protection is needed for economic development of the growth centers along the major rivers and tributaries. Projected diversification of the industrial mix, by reduction of concentration in the primary metals industries and additions to the fabricated metals and machinery and chemical industries, will be aided by freeing presently underutilized flood plain areas from flooding Pittsburgh and the other growth centers along the major rivers, where infrastructure is already provided or planned for growth, would benefit from additional upstream reservoir protection. Reservoirs could be located strategically to furnish additional control for reducing the upstream area damage situation and to store flows which discharge on the Pittsburgh and down-river urban areas.

Water damage prevention is a necessity at growth points in the Sewickley Creek watershed of Westmoreland County between Greensburg and Youngwood. The upper Loyalhanna Creek Valley, which includes the Ligonier-Latrobe area, in Westmoreland County, may warrant attention as development occurs above Latrobe, through expansion of the pressed and fabricated metals industries. In Butler County, especially in the lower Connoquenessing Creek basin at the Ellwood City industrialized area, the flood hazard is impeding expansion of ARMCO and other industrial facilities. Expansion of the Butler urban area into its upstream flood plains is similarly limited. In Beaver and Washington Counties, problems due to Raccoon Creek flooding are preventing development and diversification of industry in the flood plains, especially in the vicinity of Aliquippa.

Flooding hampers use of about 600 acres of accessible vacant industrial land in urban Washington County, along the Monongahela River. This area of Washington County is heavily industrialized and underlain with valuable metallurgical coal. Industrial sites are available at Monongahela City, Donora, Charleroi, Speers, Allenport, California and West Brownsville. Existing industries, in SIC Categories 32-36 and 28, employing some 18,000 persons, need adequate protection from frequent flooding for expansion. Rowlesburg and Stonewall Jackson Lakes, when

built, and existing Tygart Lake would have to be supplemented by additional reservoirs to furnish needed protection to the industrial sites fronting the river throughout the Monongahela River Valley.

Channel improvements, to inhibit local flooding, would assist industry location near the mouth of Pigeon Creek at Monongahela city, where the creek flows into Pool No. 3 of the Monongahela River navigation system.

About one-half the population of Washington County lives within Chartiers Creek Basin. Because of amenable surroundings and a new four-lane limited access highway system, this basin is the most desirable industrial location in the county. The existing project on Chartiers Creek, in the City of Washington, protects this large industrialized area, except downstream where some land is being industrially developed and more is potentially available. Local flooding is deterring use; specifically at an industrial site at the junction of Pennsylvania Routes 844 and 13.

Extension of the existing improvement downstream through the Arden Downs-Meadowlands area to Houston would enhance industrial sites, including one desired by the Radio Corporation of America at Meadowlands. Another downstream reach of Chartiers Creek from Scully Yard to McKees Rocks at the Ohio River (Pittsburgh Pool) is situated well for industrial development, but has periodic flooding. McKees Rocks and immediate upstream areas along about a 4-mile reach in Allegheny County, with a past record of flooding, are a part of the Pittsburgh Industrial complex. Industrial development, aided by the Chartiers Creek local flood protection project, urban redevelopment and highway improvements, is slanted toward heavy industry near the Ohio River and upstream along Chartiers Creek to Carnegie, with an additional potential for food and warehousing industries. Upstream, in the Canonsburg-Houston area, opportunity for expansion of heavy steel fabrication and light industry will be improved after completion of the uppermost component of the flood protection project.

Flood plain studies of Chartiers, Pigeon, and Raccoon Creeks and the Monongahela River are needed to determine flood potential in these valleys and to provide information for future protection programs.

Dunkard and Ten Mile Creeks in Greene County are located in a coal mining area. The county is underlain with a thick deposit of high grade coal which is being mined without regard to long term surface economic growth objectives. There may be a serious physical block to future use of desirable flood plain lands presently subject to flooding if the land is undermined and subject to settling. This applies as well to potential damsites where elimination of foundation materials for structures and impoundments will inhibit project development.

In low-lying areas of Greene County, flooding may deter establishing a comprehensive Regional Agricultural Development and Marketing Center which could stimulate regional agriculture. The

range of possibilities from this Center appears to be fully outstanding and Greene County expects to make a complete study of the potential in an application for technical assistance under the Appalachian Regional Development Act of 1965. Related to this would be development of agricultural markets, improvement of farming procedures and techniques, attraction of investment capital for agriculture, an educational program for land use conservation, development of outlets for income derived from mineral resources, a diversification of industry, development of major highway improvements and development of water resources.

Other urbanized growth centers in the water area, presently experiencing slow growth, may warrant local protection to make maximum use of remaining premium developable land when growth is resumed. Uniontown, Connellsville, and Scottdale fall into this category.

Water Area F-3. Construction of the Stonewall Jackson Reservoir will not completely relieve the recurrent water damage situation at points along the West Fork River. Floods have severely affected communities from Clarksburg downstream to the river mouth. This reservoir, in combination with comprehensive upstream watershed protection and local channel improvements, will provide complete flood protection only to Weston.

Rowlesburg Reservoir will, to some extent, protect industrial developments situated at growth points along the Monongahela River and free lands for industrial use from floods. This project can be further enhanced for flood control by combination with potential reservoirs on the major tributary streams discussed later.

Investigations of channel improvement projects and upstream watershed reservoirs for flood control are well advanced in the West Fork River basin at and below Clarksburg.

Studies of the flood problem have been made at Mannington on Buffalo Creek, where an upstream watershed project is feasible.

Local flooding problems have been studied on direct tributaries of the Ohio River in Jefferson and Belmont Counties, as at Dillonvale and Adena on Short Creek. Channel improvements and watershed protection projects appear feasible. Selection of the improvement most advantageous to local development will be made by local interests.

The high potential for growth along the Ohio River, where industrial plant sites are more plentiful and where significant flood damage could occur to existing and future development, indicates urgent need for flood plain management studies. Flood plain land use is limited by recurrent damage. A comprehensive plan would define the most desirable extent and program for flood stage reduction. Planning assistance of this kind is being made available to state and local agencies.

Water Supply and Water Quality

Sub-regional

Main stream urban areas currently exhibit no particular water supply problems to satisfy benchmark projections. However, pollution problems of many types are prevalent, particularly in the southern part of Water Area F-1, in all of Water Area F-2, and in part of Water Area F-3. Water quality problems in the Monongahela River basin indicate a substantial need for a faster moving abatement program by Federal and state agencies.

Upstream watershed areas which cannot readily and economically obtain water supply from the main rivers require water control facilities to insure good quality water for municipal, industrial and agricultural purposes. There is need for protection of existing good water quality streams and preservation of reservoir sites in these areas.

Water Area F-1. Total water requirements for present and projected supplemental irrigation in the Allegheny River basin can be supplied by individual farm groundwater or surface water development. About 77,000 acres of land appear suitable for irrigation, since rainfall during the growing season, in an average year is not sufficient to meet needs.

New York State indicates that many local areas have inadequate water supplies to meet present demands. This also applies to the large urban center of Celeron-Jamestown-Falconer, New York. The growth areas along Lake Erie including Ripley, Westfield, Fredonia, Silver Creek and Forestville have inadequate water to meet present demands. Sources of water supply are polluted at Forestville and further water supply treatment facilities are needed at Fredonia. In Chautauqua County, 50 percent of the existing water supply distribution systems are unable to furnish sustained drafts to meet fire protection requirements. Summer resort areas and proposed industrial park developments along Lake Erie have need for additional and expanded public water supply systems. Harborcreek Township, adjacent to the City of Erie, requires more water supply for industrial expansion than can be obtained by further extension of the City's water distribution system.

In Cattaraugus County, the state indicates that improved public water supply sources are needed for Gowanda and Otto water districts. Also, almost all of the existing water supply distribution systems cannot meet sustained fire protection requirements. In Allegany County, improved storage is required at Canaseraga. At Fillmore, the water supply is presently adequate but storage tanks are needed to increase the pressure. Fire protection requirements cannot be met from the existing source.

Groundwater supplies in the New York area are generally of high quality and high yield. This is particularly important in Chautauqua and Cattaraugus Counties where economic potential is very high but to some extent good reservoir sites are limited. Development of wells in these

aquifers for industrial and municipal water supply could have a very favorable effect on residential, commercial and industrial growth, and expansion.

The State of New York is conducting intermunicipal public water supply studies to plan for projects that will provide adequately for these public water supply needs.

Preservation of adequate stream quality throughout the New York area will depend largely on waste treatment facilities construction. Flow augmentation is needed to supplement adequate treatment facilities. In the western part of the area, water quality problems are expected to be reduced by a proposed treatment plant in Bonita, Chautauqua County, and by the existing Jamestown treatment plant. New York State indicates that if the Jamestown plant outlet can be joined with the Bonita outlet and both plants discharge into the Conewango Creek, the natural flows may be adequate for maintenance of quality standards.

In a survey of Pennsylvania counties, Jefferson County for one has indicated a need for a comprehensive study of water pollution and a plan for its elimination.

At St. Marys, Pennsylvania, development of major surface water supply is needed for urban and industrial water supply, particularly to maintain the carbon manufacturing plants located there.

Pollution abatement in the Upper West Branch of the Susquehanna River and its tributaries above Curwensville Reservoir is necessary to protect development potential. Water supply for Clarion, Pennsylvania, obtained from wells, is of poor quality necessitating either study of other underground water supplies or acid mine drainage pollution abatement of the surface supply. Treatment and distribution costs of Allegheny and Clarion River water are presently prohibitive. The industrial complex on the Shenango River, in the Farrell vicinity, has need for surface water storage for industrial use.

Pollution abatement problems are prevalent on the Shenango River below Sharon, Pennsylvania, due to the vast industrial complex, which extends into the Beaver River area. Thermal and other industrial pollution from the Warren-Youngstown industrial complex adds substantially to this problem, not only in the Mahoning River, but also into the Beaver River area, and below.

In Venango County, abatement of acid mine drainage pollution is needed on watersheds in the southern part of the county, and in the Allegheny River.

Brines and other oil fields wastes in Warren and Venango Counties are also contaminating the Allegheny River. Acid mine drainage and municipal and industrial wastes in the Clarion River are contributing to pollution of the lower Allegheny River.

The following tables, obtained from FWPCA^{*/}, indicate the water supply needs and the untreated waste loadings in Water Area F-1 through the year 2020 for the projected (benchmark) level of development.

TABLE 12-12
WATER SUPPLY NEEDS FOR MUNICIPAL AND
INDUSTRIAL USE, WATER AREA F-1^{1/}
(Million Gallons per Day)

<u>1960</u>	<u>1980</u>	<u>2000</u>	<u>2020</u>
500	820	1400	2000

^{1/} For explanation, see FWPCA Appendix D.

TABLE 12-13
UNTREATED WASTE LOADINGS
(Population Equivalent in 1,000's)

<u>1960</u>	<u>1980</u>	<u>2000</u>	<u>2020</u>
1650	2600	4700	6700

Water Area F-2. There is probably no other area in the sub-region which has a more abundant water supply and a more serious water quality problem. Large strip-mined areas are spilling great amounts of acid into the streams, as are abandoned deep mines, and oil and gas wells. Industries are showing signs of cooperation in pollution abatement programs. Municipal and industrial citations for exceeding legal pollution limits are common in this area. Under the Clean Streams and Strip Mines Laws, it is anticipated that an abatement and control plan will evolve to immediately abate isolated cases of pollution and to accelerate a complex, long-range abatement plan for the entire area. The technical and economic dimensions of such a plan are not known at this time.

The Commonwealth of Pennsylvania proposes among its priority projects: Casselman River mine drainage abatement as a first step toward the complete abatement of mine drainage in the Youghiogheny River basin; upper West Branch Susquehanna River mine drainage abatement to protect the water quality of the Curwensville Reservoir is a first step towards complete abatement of mine drainage in the West Branch Basin; and Clarion River basin mine drainage abatement to restore water quality in the Clarion River and its major tributaries.

A comprehensive mine drainage abatement program for the entire Monongahela River is also proposed. As a start, Federal-state abatement studies^{**/} are being made for the Monongahela River, Chartiers Creek,

^{*/} FWPCA, Appendix D.

^{**/} Pennsylvania Ten Year Acid Mine Drainage Abatement Program, Monongahela River Enforcement Conference, etc.

Clarion River, Conemaugh River, and Raccoon Creek. Abatement is prerequisite to maximum use of the land for residential, commercial, and industrial developments.

Development of Raccoon Creek for water supply could be extremely valuable to nearby urban, industrial development along the Ohio River. Its polluted condition would limit use of a potential impoundment in the lower creek basin. The lower Raccoon Creek area above Aliquippa could be impounded for multiple-purpose use, and would create an attractive industrial and recreation area in the midst of metropolitan Pittsburgh. Multi-purpose locations as favorable as this are rare because of industrialization. A combination of economic factors, resulting from a project at this location, indicates high economic development benefits if pollution can be controlled and abated.

The following FWPCA Tables indicate the water supply needs and the untreated waste loadings in Water Area F-2 through year 2020 for the benchmark level of development.

TABLE 12-14
WATER SUPPLY NEEDS FOR MUNICIPAL AND
INDUSTRIAL USE, WATER AREA F-2^{1/}
(Million Gallons per Day)

<u>1960</u>	<u>1980</u>	<u>2000</u>	<u>2020</u>
2550	3200	4050	6050

^{1/} For explanation, see FWPCA Appendix D.

TABLE 12-15
UNTREATED WASTE LOADINGS
(Population Equivalent in 1,000's)

<u>1960</u>	<u>1980</u>	<u>2000</u>	<u>2020</u>
4260	5700	8800	16,000

Water Area F-3. The water supplies for Water Area F-3 are ample from the Ohio River and associated alluvium to achieve benchmark needs of immediately adjacent counties. Clarksburg, West Virginia, and upstream areas which might have significant development, will require additional water supply development. Impoundments would be the most likely source of additional water supply in these areas.

The State of West Virginia is concerned about industrial water pollution. Along the Ohio River, waste abatement efforts need to be continued by the Weirton-Wheeling area primary metals industry.

The growing chemical industry along the river presently has varying degrees of treatment, but additional treatment capacity, presently earmarked, will be necessary. The pottery industry, located in the northern area, will require a continuing pollution abatement program for suspended solids removal.

Mine drainage from local areas is partially treated by installed facilities. A pilot treatment plant is in operation to determine final procedures to be used. The municipal waste program in this area is well developed; however, the Brooke County system serves about 7 percent of its population whereas the largest county in population, Ohio County, serves about 80 percent of its population.

In the Monongahela River area, it is anticipated that the apparel and machinery industry will substantially increase. The glass industry will continue to exert heavy demand for usable water. Acid mine drainage concerns the State of West Virginia because of water quality deterioration and serious adverse aesthetic effects. Although there are 11 sewage treatment plants located in this area, some of the major growth centers do not have any treatment. The state is organizing a closer working relationship with the municipalities to improve the waste treatment program.

Recreation opportunities would be created by good quality water, especially at existing or planned large impoundments. Establishment of a "broad water" complex at Tygart reservoir requires water of better quality for maximum development. Acid mine drainage flowing into the reservoir makes water quality marginal. Maximum recreation use of Stonewall Jackson and Rowlesburg Reservoirs requires that water quality controls be implemented for protection against pollution.

The following FWPCA Tables indicate the water supply needs and the untreated waste loadings in Water Area F-3 through year 2020 for the benchmark level of development.

TABLE 12-16
WATER SUPPLY NEEDS FOR MUNICIPAL AND
INDUSTRIAL USE, WATER AREA F-3^{1/}
(Million Gallons per Day)

<u>1960</u>	<u>1980</u>	<u>2000</u>	<u>2020</u>
380	550	930	1600

^{1/} For explanation, see FWPCA Appendix D.

TABLE 12-17
UNTREATED WASTE LOADINGS
(Population Equivalent in 1,000's)

<u>1960</u>	<u>1980</u>	<u>2000</u>	<u>2020</u>
760	1100	2000	4300

Land Use and Development

Sub-regional

Present land development potential is rather poor in the sub-region. Developable sites for industry are mainly located on narrow flood plains subject to flooding. Agricultural lands throughout the sub-region are also hindered by the flooding problem, although agriculture employment is declining. Between 1980 and 2020, the sub-region population is projected to increase from about 5.7 million to more than 9.3 million. Land will be needed to accommodate this additional population; for recreational, protective and productive purposes and to secure a more attractive and desirable environment.

Reversal of current economic trends necessitates preservation of existing useful land areas in the hinterlands of the urban complexes. Protection against exploitive removal of mineral resources and the reclamation of lands already disturbed by activities inhibiting further use is needed.

Conservation treatment of areas surrounding towns and cities would enhance land value for residential, commercial and industrial purposes. Serious consideration must be given to preservation of areas with outstanding scenic value and other areas having special values as prime agriculture and forest areas. Section I, Chapter 11 states that the sub-region's wild and scenic river potential would preserve land and water areas of outstanding scenic and recreational value near urban and suburban development.

Sixteen million acres within Sub-region F requires explicit land management to serve projected economic needs. In addition to present rate of accomplishment of present U.S. Department of Agriculture's programs, an acceleration of these programs including conservation treatment and improved management, and land use changes for projected economic growth and development, will be required on about 6 percent of the total land area of the sub-region. Coal strip mining has left vast acreages denuded and nonproductive. Rehabilitation of the despoiled 300,000 strip-mined acres is an urgent requirement.

Additional usable acreage will be needed in Sub-region F to accommodate anticipated economic growth. Urban areas must expand to serve home-site, service, commercial and industrial development. Reserved acreage is needed for potential reservoir construction and for recreation, fish and wildlife and related development. Land so reserved needs preservation and/or reclamation to maintain and enhance its natural environmental features and aesthetic value. Land acreage needed for future industrial, commercial, and residential development in Sub-region F, based on economic growth projections, are summarized in Table 12-18.

TABLE 12-18
 ADDITIONAL LAND REQUIREMENTS, SUB-REGION F BY BASINS
 BASED ON FUTURE ECONOMIC GROWTH PROJECTS
 (Acres)

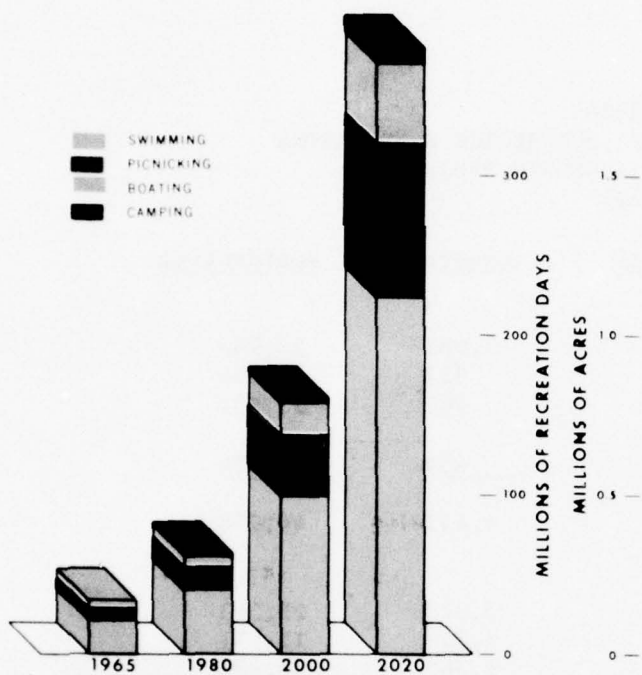
<u>Basin</u>	<u>Industrial</u>	<u>Commercial</u>	<u>Residential</u>
1965-1980			
Allegheny	6,666	2,082	17,945
Monongahela	3,704	953	10,158
Beaver	3,544	962	11,631
Upper Ohio (Main stem R.M. 126.4)	<u>1,594</u>	<u>434</u>	<u>5,024</u>
TOTAL, 1965-1980	15,508	4,431	44,758
1980-2000			
Allegheny	9,774	3,028	25,563
Monongahela	4,856	1,244	12,571
Beaver	16,086	4,362	52,903
Upper Ohio (Main stem R.M. 126.4)	<u>2,278</u>	<u>640</u>	<u>7,066</u>
TOTAL, 1980-2000	32,994	9,274	98,103
2000-2020			
Allegheny	20,556	6,053	58,261
Monongahela	12,998	3,449	39,223
Beaver	2,780	766	8,976
Upper Ohio (Main stem R.M. 126.4)	<u>4,490</u>	<u>1,234</u>	<u>13,939</u>
TOTAL, 2000-2020	40,824	11,502	120,399

Recreation and Environmental Enhancement

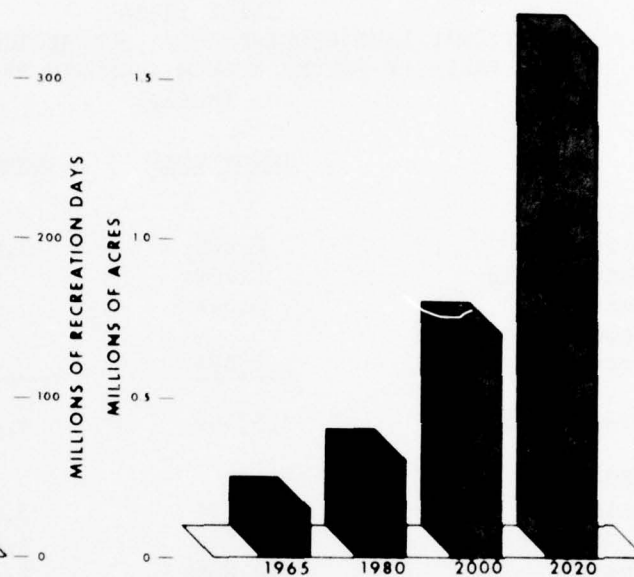
Sub-regional

The existing water resource investments provide limited recreation opportunities. The opportunities are to some extent negated by the water quality problems inherent in the sub-region.

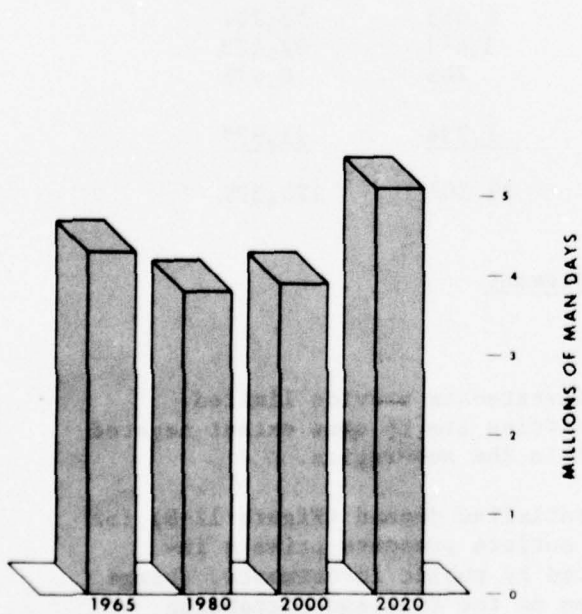
The extraordinarily large unsatisfied demand (Figure 12-8) for additional water related recreational outlets presents private investment potential that could be induced by public investments. Large concentrations of population and income at the Erie and Pittsburgh areas can support a complex of recreation activities which would aid in accelerating economic development of the sub-region. By deliberate design, this should be exploited to create a large number of new



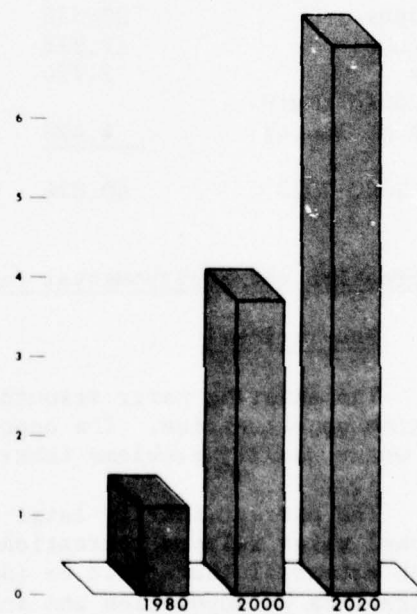
**UNSATISFIED DEMAND FOR
WATER ORIENTED
OUTDOOR RECREATION**



**ADDITIONAL WATER AREAS NEEDED
TO PROVIDE WATER ORIENTED
OUTDOOR RECREATION**



**UNSATISFIED DEMAND
FOR FISHING**



**UNSATISFIED DEMAND
FOR HUNTING**

opportunities for recreational employment. Trade and service activities are being eagerly sought by many of the county planning commissions.

The outdoor recreation (all activities) and fishing and hunting needs in Sub-region F, in terms of recreation days and in acres of water, is shown in the following table.

TABLE 12-19
OUTDOOR RECREATION NEEDS OF THE
SUB-REGION IN
RECREATION DAYS AND ACRES OF WATER

Years	General Recreation ^{1/}	Fishing and Hunting ^{1/}	Total Recreation ^{1/}	Total Water ^{2/}
1965	34.0	4.3	38.3	162.7
1980	63.8	4.9	68.7	288.1
2000	160.9	7.6	168.5	692.8
2020	380.9	12.0	392.9	1,611.9

^{1/} In millions of visitor days.

^{2/} In 1,000 acres.

It is evident from Table 12-19 that the total water area to meet the enormous recreational demand for the sub-region cannot be satisfied, but water resource investments should be used to obtain the maximum development. Competition for physically feasible sites is intense and these opportunities may be pre-empted either by other economic developments or by recreational developments of relatively small scope by state and local agencies.

Even with minimal provision of recreational facilities at existing Federal reservoirs, the record of visitations^{*/} furnishes an impressive illustration of the extent to which these resources are sought for recreational use.

In addition, there are five authorized Upstream Watershed Projects with recreation as a project purpose. These projects will provide 2,188 acres of water surface for an estimated 217,380 annual visitor days. In 1966 an estimated 99,200 visitor days were recorded in the Allegheny National Forest. There are at present 15 recreation developments within the Forest with combined capacity of 3,186 persons-at-one-time.

^{*/} See Visitation Records Tabulation, Table 12-20.

TABLE 12-20
RECREATION VISITATION
EXISTING CORPS OF ENGINEERS RESERVOIRS

Reservoir	Summer Pool Area (Acres)	1950	1951	1952	1953	1954	1955	Visitation (1,000's)	1956	1957
ALLEGHENY RIVER SUB-BASIN										
A-1 Upper Allegheny Sub-Division										
a. Allegheny (Water Area F-1)	12,080									
b. Tionesta (Water Area F-1)	480*	129	138	115	259	378	456	460	512	512
Total A-1	12,560	129	138	115	259	378	456	460	512	512
A-3 Middle Allegheny Sub-Division										
a. Crooked Creek (Water Area F-2)	350*	331	305	378	593	644	712	457	82	82
b. East Branch Clarion River (Water Area F-1)	1,160				135	131	114	104		
c. Mahoning Creek (Water Area F-2)	170*	23	21	26	22	24	17	21		
Total A-3	1,680	354	326	404	750	799	843	582		
A-4 Kiskiminetas Sub-Division										
a. Conemaugh River (Water Area F-2)	300*				**89	81	53	82		
b. Loyalhanna (Water Area F-2)	210*	35	20	23	22	22	44	86		
Total A-4	510	35	20	23	111	103	97	168		
TOTAL ALLEGHENY RIVER SUB-BASIN	14,750	518	484	542	1,120	1,280	1,396	1,210	1,442	1,442
BEAVER RIVER SUB-BASIN										
B-1 Shenango River Sub-Division										
a. Shenango River (Water Area F-1)	3,560									
Total B-1	3,560									
B-2 Remaining Portion of Beaver River Sub-Basin										
a. Berlin (Outside Appalachian Region)	3,590	114	135	163	170	291	182	230		
b. Mosquito Creek (Outside Appalachian Region)	7,850	125	113	123	215	454	325	419		
c. West Branch (Outside Appalachian Region)	2,650									
Total B-2	14,090	239	248	286	385	745	507	649		
TOTAL BEAVER RIVER SUB-BASIN	17,650	239	248	286	385	745	507	649		
MONONGAHELA RIVER SUB-BASIN										
M-1 Tygart River Sub-Division										
a. Tygart River (Water Areas F-3 and G-5)	1,740	106	125	104	212	418	432	448		
Total M-1	1,740	106	125	104	212	418	432	448		
M-4 Youghiogheny River Sub-Division										
a. Youghiogheny River (Water Areas F-2, B-2 & B-3)	2,840	249	342	402	442	512	452	380		
Total M-4	2,840	249	342	402	442	512	452	380		
TOTAL MONONGAHELA RIVER SUB-BASIN	4,580	355	467	506	654	1,030	884	828	1,442	1,442
TOTALS	36,980	1,112	1,199	1,334	2,159	2,955	2,787	2,687	3,932	3,932

* Minimum pool of a "flood control only" reservoir
** First year of operation

TABLE 12-20
RECREATION VISITATION
EXISTING CORPS OF ENGINEERS RESERVOIRS

	1953	1954	1955	Visitation (1,000 Visitor Days)			1959	1960	1961	1962	1963	1964	1965	1966	1967
				1956	1957	1958									
	<u>259</u> 259	<u>378</u> 378	<u>456</u> 456	<u>460</u> 460	<u>518</u> 518	<u>728</u> 728	<u>665</u> 665	<u>462</u> 462	<u>552</u> 552	<u>594</u> 594	<u>531</u> 531	<u>573</u> 573	<u>472</u> 472	<u>484</u> 484	<u>**1,391</u> 544 1,935
	<u>593</u> 135 <u>22</u> 750	<u>644</u> 131 <u>24</u> 799	<u>712</u> 114 <u>17</u> 843	<u>457</u> 104 <u>21</u> 582	<u>822</u> 70 <u>24</u> 916	<u>708</u> 90 <u>20</u> 818	<u>892</u> 121 <u>20</u> 1,033	<u>1,009</u> 117 <u>16</u> 1,142	<u>836</u> 81 <u>17</u> 934	<u>491</u> 140 <u>14</u> 645	<u>308</u> 106 <u>24</u> 438	<u>366</u> 122 <u>26</u> 514	<u>356</u> 89 <u>20</u> 465	<u>415</u> 74 <u>20</u> 509	<u>422</u> 75 <u>29</u> 526
**89	<u>22</u> 111 1,120	<u>81</u> 22 1,280	<u>53</u> 44 1,396	<u>82</u> 86 1,210	<u>80</u> 111 1,625	<u>69</u> 127 1,742	<u>83</u> 110 1,891	<u>92</u> 105 1,801	<u>103</u> 102 1,691	<u>123</u> 102 1,464	<u>103</u> 112 1,184	<u>122</u> 132 1,341	<u>110</u> 152 1,199	<u>123</u> 128 1,244	<u>127</u> 125 2,713
														<u>**133</u> 133	<u>554</u> 554
	<u>170</u> 215 <u>385</u> 385	<u>291</u> 454 <u>745</u> 745	<u>182</u> 325 <u>507</u> 507	<u>230</u> 419 <u>649</u> 649	<u>251</u> 572 <u>823</u> 823	<u>305</u> 515 <u>820</u> 820	<u>327</u> 555 <u>882</u> 882	<u>482</u> 582 <u>1,064</u> 1,064	<u>737</u> 1,019 <u>1,756</u> 1,756	<u>628</u> 1,001 <u>1,629</u> 1,629	<u>524</u> 1,050 <u>1,574</u> 1,574	<u>636</u> 755 <u>1,391</u> 1,391	<u>573</u> 1,387 <u>1,960</u> 1,960	<u>743</u> 1,310 <u>2,053</u> 2,186	<u>861</u> 1,215 <u>**265</u> 2,341 2,895
	<u>212</u> 212	<u>418</u> 418	<u>432</u> 432	<u>448</u> 448	<u>625</u> 625	<u>550</u> 550	<u>475</u> 475	<u>457</u> 457	<u>421</u> 421	<u>396</u> 396	<u>465</u> 465	<u>479</u> 479	<u>509</u> 509	<u>559</u> 559	<u>558</u> 558
	<u>442</u> 442 654	<u>512</u> 512 1,030	<u>452</u> 452 884	<u>380</u> 380 828	<u>566</u> 566 1,191	<u>442</u> 442 999	<u>584</u> 584 1,059	<u>595</u> 595 1,052	<u>593</u> 593 1,014	<u>597</u> 597 993	<u>640</u> 640 1,105	<u>543</u> 543 1,022	<u>623</u> 623 1,132	<u>803</u> 803 1,362	<u>1,014</u> 1,014 1,572
	2,159	2,955	2,787	2,687	3,639	3,561	3,832	3,917	4,461	4,086	3,863	3,754	4,291	4,792	7,180

Water Area F-1. This water area abounds in natural man-made recreational assets. Reservoirs, state parks, Lake Erie, the Allegheny National Forest and many other assets are located in the area. The Allegheny Reservoir and the Allegheny River communities have high potential for recreation growth, particularly in the northern 6-county area.

The Commonwealth of Pennsylvania expects that a large recreational complex will form in central Pennsylvania, brought on by pressure from urban complexes east and west. The State of New York expects that the New York City area will demand facilities to its west, particularly along the Southern Tier Expressway. It would seem very likely that pressures from the east and west will require development of water-based recreational facilities possessing a remarkable combination of scenic and natural resources, and superior highway access.

The upper Allegheny River Valley, extending northward from the mouth of the Clarion River to its headwaters, could support any sub-regional plans for recreational development. All the recreation potential of the water area will be needed. Recreation demand requires a well coordinated recreational complex, including a potential reservoir on the Clarion River, the Allegheny River Valley, the Allegheny Reservoir, the Allegheny National Forest, Cook Forest State Park and other state lands and parks, the proposed Otocsin Reservoir and Recreation Area, and numerous other selected potential reservoirs and recreation opportunities.

The Commonwealth of Pennsylvania estimates that, if properly executed, Otocsin would enable the state and the Clearfield-DuBois community to offer private capital opportunity for development of a non-competitive recreation investment. There are numerous proposed facilities at Otocsin ideally suited for private capital. The unique location and planning of Otocsin would present business men and visitors with a captive market. Initially, this facility would have an estimated capacity of about 150 thousand people per day. Reasonable average daily attendance during a summer day, in early development stages, will be an estimated 50 thousand people. Gross annual expenditure of 30 million dollars would be anticipated based on an average expenditure per day of 25 thousand dollars. The Commonwealth believes that the broad concept of Otocsin would fulfill an ever-increasing recreational need, create new jobs, provide an opportunity for successful investments and help to establish an attractive environment and new industries. Translated into employment, this would result in 950 (annual equivalent) jobs with a payroll estimated at 9.8 million dollars annually. Another 950 jobs in service industries are expected to result as well. For the economy of Clearfield County this development promises to be an important economic stimulant.

The Commonwealth of Pennsylvania and the State of New York view this water area, not only as a recreational development in the central areas of the two states, but also enhancing the quality of life and

environment of the entire sub-region. Opportunity exists for development of a comprehensively integrated recreation complex, extending from an existing cluster of reservoirs in the Youngstown area northeast to the authorized French Creek reservoirs, Lake Erie-Lake Chautauqua-Allegheny Reservoir, and continuing in a southwest direction through the area encompassing the East Branch Clarion-Tionesta Creek-Piney (Clarion River, private-power) reservoirs. Presently, these facilities and Curwensville Reservoir and proposed Naturealm, similar to Otocsin in objectives, are unrelated except by location and natural resources.

The interior of this area possesses some of the most striking physical attractions of the sub-region, including the Allegheny National Forest, whose development and extent could be expanded. With the anticipated convergence upon the two central-state areas of people from the six surrounding major metropolitan centers with tremendous recreational demand, specific potentials obviously exist to induce private investments. The size of this area, this potential recreation pressure, and the need for a diversified, integrated, recreational complex could extend the concept of the Otocsin-Naturealm-type project into a much broader area, enhancing the water area's competitive advantage in attracting industry and growth.

The designation of the Allegheny River as a wild and scenic river and procurement of scenic easements would protect this area from detracting encroachments. Highway access for this type of recreation complex is practically assured. Additional highway improvements connecting the central Warren urban area to the Southern Tier Expressway, to Jamestown, New York, via a route passing along Conewango Creek, and other short feeder roads, would make this entire area available for private recreational development and industrial site development. Eventually, potential highways from Philadelphia to Erie and from Scranton to Cleveland will probably be desirable to link this huge recreational complex to additional major metropolitan centers. All the growth centers in the water area would be enhanced by this resource enhancement. The General Development Plan for Warren County^{*/} provides short-term guidance for infrastructure needs and for regulated land use, including prohibition of development in areas subject to flooding.

Other projects in the area include the East Branch Clarion River reservoir in Elk County, Pennsylvania, which has a low water regulation (summer) pool, about 1,200 surface acres of water area, and high recreation potential inhibited by mineral acidity from its tributary area. A program of acid drainage abatement, land treatment, and land management could effectively reduce the acid and enhance the environment.

^{*/} Published in September 1967 for the Warren County Planning Commission by Reed-Neathery Associates.

The existing Piney Reservoir on the Clarion River presents limited opportunity for recreational improvement because of its relatively small pool area and mineral acidity from several identifiable mine sources. A program of acid abatement, land reclamation of the strip-mined areas and recapture of the existing power license for this project would be a prerequisite to development of an optimum multiple-purpose reservoir project at a downstream site near St. Petersburg, Pennsylvania. The recreational enhancement would be tremendous and would provide an environment for sizable development.

The Upstream Watershed Program of the U.S. Department of Agriculture could help meet the water oriented recreation needs of the Water Area. The 10 potential upstream watershed projects could provide 6,000 acres of water for 4,157,400 recreation days annually. This would be provided through more scattered, secluded, smaller type multiple purpose impoundments.

Water Area F-2. Concentration of population in this water area creates a tremendous recreation demand pressure. With population concentration, pressures of urbanization, growing per capita water use, and increasing utilization of open lands, there is a growing need to socially balance the multiple uses of land in the water area for agriculture, recreation, highways, conservation, and urban growth. How to strike the best balance between these multiple uses is an overriding concern in the orderly management of private and public land.

The reaches of the Ohio and Allegheny Rivers at Brunot, Six-Mile, Twelve Mile, Nine Mile, Jacks and Sycamore Islands warrant investigation of recreation potential to satisfy boating-oriented activities.

Opportunities for large-scale water-oriented recreational development on Big Sandy Creek in Fayette County, Dunkard Creek in Greene County, Ten Mile Creek in Greene and Washington Counties, Raccoon Creek in Washington and Beaver Counties, Buffalo and Connoquenessing Creeks in Butler County, Loyalhanna Creek in Westmoreland County, and on streams draining into the Ohio River in Sub-region G, such as Laurel Hill Creek, are needed to expand the water area's recreation resources. These can be provided by constructing water impoundments and developments contiguous to river areas (Ohiopyle State Park for example) with maximum potential to induce investments by the private recreation industry. Other developments, such as the extensive Laurel Ridge, although not dependent upon water-based recreation, can be considered as integral with these in offsetting the total recreational pressure.

The Big Sandy Creek basin in Fayette County, Pennsylvania, and Preston County, West Virginia, is an especially attractive wilderness area. A multi-purpose reservoir project could be developed here to include a large private recreation investment. A substantial recreation market exists, and the project is considered to have high priority by the Commonwealth of Pennsylvania and by local

interests, including the Pennsylvania Economy League. For Fayette County, which has suffered severe mining employment losses, recreation development would be particularly important. Industrial development is making headway in adjacent county areas where this impoundment would be of particular environmental importance. The Big Sandy Basin is located in the Southern Laurel Highlands which is nationally known and experiences a large tourist and vacationer visitation.

The potential impoundments, mentioned for recreation use, would provide environmental enhancement badly needed in this water area. Expanded development of recreation facilities at existing reservoirs would also be of significant value. At Loyalhanna Creek Reservoir, however, improvement would require reduction of acid-mine drainage to improve water quality and possibly a higher recreation pool level than now exists.

Laurel Hill Creek impoundment in adjacent Somerset County would materially enhance the water area. It could become part of a comprehensive recreational complex including Ohiopyle State Park (Pa.), Coopers Rock (W. Va.), the proposed Conemaugh Gorge State Park (Pa.), proposed Laurel Ridge State Park (Pa.), a proposed scenic drive along Chestnut Ridge (south from Uniontown to Corridor E), potential Big Sandy Creek Reservoir, Rowlesburg Lake and Mont Chateau State Park (W. Va.), Ferncliff Nature Reserve (Western Pa. Conservancy, Ohiopyle), and Kaufmann Conservation Area (near Ohiopyle) - all south of Pittsburgh. Another grouping of boldly conceived opportunities are the Yellow Creek State Park (Pa.), Buffalo Creek (Pa.), Moraine State Park (Pa.), Jennings Blazing Star Nature Reserve (Western Pa. Conservancy), and Raccoon State Park (Pa.) - all north of Pittsburgh. The varied recreation environment presented by these opportunities is remarkable.

The need for environmental enhancement embraces conservation by protection and development of the water area's remaining clean water resources. Of several thousand miles of rivers and streams in the water area only about 500 miles are regarded as fishing waters. Of this, about 150 miles on the Beaver, Monongahela, the Allegheny below Kittanning, and the Ohio Rivers support only poor quality fishing. A very small percentage of stream lengths support trout. Screening of water area streams by water quality characteristics would indicate feasibility for future resource development. Such analysis and coordination with the states' educational and enforcement efforts would preserve this environmental enhancement potential. The outstanding streams merit early and aggressive conservation and preservation by declaration as wild or scenic streams or by earmarking for water resource or water-oriented recreational development. Streams so qualified would enhance the environmental advantages of the water area. The clean streams are concentrated in a few spots in eastern Westmoreland County, southwest Washington County, eastern Beaver County, central Butler County and eastern and northeast Armstrong County.

The water area has few lakes of high water quality. The inferior waters of the Crooked Creek and Mahoning River Reservoirs could be upgraded by elimination or control of acid mine drainage to enhance their value for recreation. Restoration of the Conemaugh and Loyalhanna Reservoirs to high value for water recreation would require substantial effort, but should be initiated for potential enhancement value.

Portions of the Youghiogheny, Allegheny, Clarion and Little Beaver Rivers have been selected for investigation under the Wild and Scenic River Act. Scenic easements along these streams in Water Area F-2 could provide scenic corridors exclusively devoted to primitive or scenic trails. A corridor along the Youghiogheny River from Crellin to Friendsville (Youghiogheny Reservoir) and from Ohlerville to Connellsville could be coordinated with recreational development at the existing Youghiogheny Reservoir. Improvement to this reach might result from the addition of a reservoir at its upstream end in the vicinity of Crellin to supplement natural runoff and improve its wild and scenic character with "white water" during low flow periods. The Youghiogheny Reservoir provides this to the mid-Youghiogheny River reach from the dam to Connellsville. Supplementary storage for this purpose could also be furnished by a reservoir on Laurel Hill Creek (A fish-for-fun stream) and on the upper Casselman River, especially with abatement of acid pollution in the latter area. Scenic corridors along these streams would preserve their natural beauty and would facilitate regulation of flood plain usage without restricting growth at appropriate locations.

A scenic easement along the Clarion River in Water Area F-2, and upstream along the Allegheny River, in Water Area F-1, would provide a corridor which could begin at the Point State Park at the tip of the Golden Triangle at Pittsburgh, go along the lower Allegheny River and its potential island developments to the beginning of the old Baker Trail near Garvers Ferry, to Cook Forest State Park. The Little Beaver Creek wild river area is outside of Water Area F-2, and would extend from a point in Columbiana County to the Ohio River at East Liverpool at the northernmost point of Water Area F-3. A scenic corridor along this stream at the western boundary of Water Area F-2 would be easily reached by U.S. Route 30 from the Raccoon Creek State Park area.

Buffalo Creek, a headwater tributary in Armstrong County, can be developed for growth because of its outstanding natural features. This excellent site, enhanced by the admirable scenic locale in the Buffalo Creek area in Armstrong County, is near the Pittsburgh industrial complex. Roaring Run and South Branch Pine Creeks and the Allegheny River Trail in Armstrong County, especially the latter, have excellent potential for all types of recreational uses. A proposed scenic highway in Armstrong County, paralleling a portion of the river, would make the area more attractive. Development could extend upstream through Clarion, Venango, and Warren Counties especially

along the shore of the river. Another area with outstanding scenic qualities and potentials for recreational development, including private investments, would be situated along Crooked Creek in Armstrong County, from the Allegheny River to the existing Crooked Creek State Park and Crooked Creek Reservoir. This area could be developed into an intensively used recreational area. Development would be aided by one of the proposed new scenic highways. Another site of considerable merit is located on Little Beaver Creek in Beaver County. It could be developed into an excellent major recreational facility by tying in with the large state park currently being developed in the adjacent county in the State of Ohio. Portions of this site have been strip-mined and would have to be reclaimed for recreational use. Two proposed scenic highway routes would pass through portions of this site.

Raccoon Creek Valley could be linked with existing Raccoon Creek State Park in the southern part of Beaver County. It would enhance the valley environment which contains flood plains and other land areas well suited for industrial use. Here again, strip mine reclamation would be necessary.

A well coordinated set of recreational opportunities can be made available if efforts are made to preserve the present open spaces which concentrically surround the area. The best possibilities are: (1) a major water-oriented scenic trail along the Allegheny River, mentioned above; and (2) a major scenic highway-recreational corridor in the eastern part of Westmoreland County from Greensburg to the Westmoreland-Somerset line.

A large complex of recreational features, including Naturealm to the east, would capitalize the relatively rugged topography, and would be a large conservation area composed of a series of smaller conservation areas. The Laurel Ridge Conservation Area, a series of parks, would link together many state game lands and state forests situated in the Laurel Mountains portion of Westmoreland, Fayette and Somerset Counties. This conservation area has outstanding qualities for future recreational use and is highly recommended for acquisition and development for recreational purposes. A suggested recreation and conservation corridor would parallel Route 30 Scenic Corridor from a point just east of Greensburg, through the Chestnut Mountains and the Ligonier Valley, into the Laurel Mountains at the Somerset County line. This route is flanked by magnificent rolling hills and farms, forested steep slope areas and the highlands of the Laurel Mountains. Scenic qualities of this corridor and the potential for its recreational use are excellent. The Loyalhanna Gorge Scenic Area, in the Chestnut Mountains along this same potential scenic corridor route, has excellent potential if acquired before despoilation, the inroads of which have already begun. Expansion of the present Loyalhanna Reservoir area and the Conemaugh River Reservoir area, as part of the total conservation area development, would connect these developments and enhance

possibilities for the entire complex. The Conemaugh-Chestnut Gorge, situated in the Chestnut Mountains along and adjacent to the Conemaugh Gorge area, and the Conemaugh-Laurel Gorge located in the Laurel Mountains, if developed for water-oriented recreational potential and scenic highway corridor possibilities, would provide enhancement for future economic growth of the water area. Ohiopyle State Park and private resort developments round out the picture.

The relatively mountainous area surrounding the urban growth centers, the highway access presently available - together with the Appalachian Corridors M and N - provide environmental enhancement of state-wide significance. Benefits could be obtained from tourism and private investments in recreation. The area desire to change the public image of this industrial area from the past picture of a grimy - sooty environment should abet economic development. Enhanced economic development potential of the area should encourage state and other public planning bodies to accelerate activities to provide public recreation investment to further economic development goals.

The Upstream Watershed Program of the U.S. Department of Agriculture could help meet the water oriented recreation needs of the Water Area. The 10 potential upstream watershed projects could provide 6,000 acres of water for 2,030,000 recreation days annually. This would be provided through more scattered, secluded, smaller type multiple purpose impoundments.

Water Area F-3. Although recreation demand has increased markedly, there have been no large-scale additions to recreational opportunities in the water area in recent years; not since the construction of the Tygart Lake project in 1938. The potential water resource plans of West Virginia,* / particularly its State-Wide Recreation Plan, feature dynamic planning offering relevant, systematic overall policy, including a citizen education program, to guide the future of its water resources and to provide maximum satisfaction from use of water resources. Broad goals are set in which, among others, the needs for recreation are indicated. The Recreation Plan designated two state sub-region natural watershed planning areas for state recreation investment. "Broad water" recreational opportunities are pinpointed among the needed recreation areas, and needed facilities are identified in each state sub-region, including the Tygart Lake in the Upper Monongahela-Cheat sub-region and the Leading Creek Lake in the Little Kanawha - Upper Ohio sub-region. Developments at these two lakes, especially private recreation industry investments under state jurisdiction and control, could offer employment opportunities to offset declining industrial employment in the Upper Monongahela River area, and circumvent the scarcity of state funds. The large unsatisfied demand for recreational facilities in this area could furnish a market inducement for private investment which would work with the state to develop a recreation complex.

* / A Design for a Water Resources Plan, 1967.

"Broad water" opportunities could be supplemented by development of a well-integrated comprehensive recreational program involving additional strategically situated reservoirs. Teter Creek and Laurel Creek sites could become valuable adjuncts to the Tygart Lake development and provide additional recreational area and storage supplementation to moderate the drawdown requirements placed on the Tygart Lake project.

Three potential reservoirs in Sub-region G, which are located in the Tygart River drainage pattern, have a high potential for recreational development at locations on the Upper Buckhannon River, the Middle Fork River and the Upper Tygart River. The Middle Fork River site would complement Audra State Park which, although relatively small, is located in an exceptionally beautiful natural site.

The existing environment along the Ohio River is one of beauty with pollution. The Monongahela River sector also possesses scenic beauty. There could be private investments in a recreational complex diversified to satisfy any demand. Development of a complex of this size could result from the West Virginia State-Wide Recreation Plan. Guidelines for this plan have well defined objective. There are, however, no immediate projects under consideration or in prospect. Potential impoundments in the headwater areas of the Buckhannon, Middle Fork, and Tygart Rivers in combination with the Stonewall Jackson and Rowlesburg Lakes, could provide recreational complex nucleus. Growth centers are located immediately below these potential lakes, at downstream points, and in associated areas. Appalachia Highway Corridor D-E would enhance the opportunity for development of additional facilities.

An unusual opportunity is presented at the site of Big Sandy Creek, in Fayette County, where a full range of facilities could be developed, including vacation homes, a lodge, a marina, and an air strip. Family type recreation activities are needed in connection with improved motel and associated facilities. The 80-mile segment of Corridor D between Parkersburg and Clarksburg will be a direct route between the populous Ohio Valley and the mountain resort areas in eastern and southern West Virginia. Prospects exist for a quality motel and restaurant along this route, since water-oriented recreation facilities at potential reservoirs could be developed in this area.

Opportunities exist for state or private development of river front property along the Ohio River to supplement boat launching areas. Construction of marinas with overnight accommodations would enhance the attractiveness of these areas, if fairly level wooded sites with highway access are made available along the river.

Two reservoirs, now in the early planning stages, are being considered for tributaries of the Little Kanawha River. West Fork Reservoir (Sub-region G) and Leading Creek Reservoir would provide extensive facilities with scenic beauty and available highway access.

Maintenance of a recreation pool level in these reservoirs for as long a period as possible during the recreation season would enhance this potential.

The Upstream Watershed Program of the U.S. Department of Agriculture could help meet the water oriented recreation needs of the Water Area. The 11 potential upstream watershed projects could provide 6,000 acres of water for 510,700 recreation days annually. This would be provided through more scattered, secluded, smaller type multiple purpose impoundments.

Navigation

With the exception of Erie and Chautauqua Counties which border on Lake Erie, water transportation is not available to growth centers located north from the Pittsburgh urban complex to Lake Erie. The existing navigation system is unable to sufficiently exploit the centrality of the sub-region's geographic position. Bulk commodities move southward by water to down-river markets. There are not yet sufficient water transportation opportunities available to accommodate future shipments of bulk commodities, nor are there river transport connections to other modes of transportation. Both of these will be necessary when more diversified industrial structure develops with reduced emphasis on heavy industry.

The Allegheny River Valley has particular potential for development because of natural resources providing a base for growth in the chemical and aluminum industries. Attractive locational factors could be utilized if navigation on the Allegheny River would be provided beyond existing Lock and Dam No. 9. Fullest advantage of this potential could be realized through river transportation connections linking developments in the Allegheny River Valley to megalopolis north, east and west of the sub-region via connection in the Erie urban complex.

Existing navigation facilities in the Allegheny River basin are only effective in supporting commerce in its downstream reach, with a large portion of its commercial potential relatively unused. Clarion, Oil City, Franklin, Titusville and Warren, Pennsylvania, growth areas have the economic potential to utilize navigation extension.

Bulk commodity and other transportation opportunities exist to the north-east-west megalopolis of the lake cities of Chicago, Cleveland, Detroit, and Buffalo and the Atlantic Coast cities of New York and Boston. Advantageous sub-regional opportunities would be provided if direct overland or water transportation routes to Erie or some other lake harbor existed. Regardless of the mode of transportation - air, rail, water, pipeline, highway or conveyor - diversification of the sub-region industrial base would receive a valuable impetus by providing water transport to these important markets.

An urgent need is evident for continued implementation of modern high-lift dams with larger locks to efficiently handle increasing volumes of tow operations. The greatest potential use of river navigation facilities is on the Ohio River. Completion of Hannibal Locks and Dam extends this system to New Martinsville. This, in addition to dam modernization downstream, furnishes the Ohio River area with potential for accelerated industrial development if adequate water damage prevention, and other needs are met. Upstream, completion of Grays Landing and Point Marion Lock and Dam projects extend Monongahela River facilities releasing development potential.

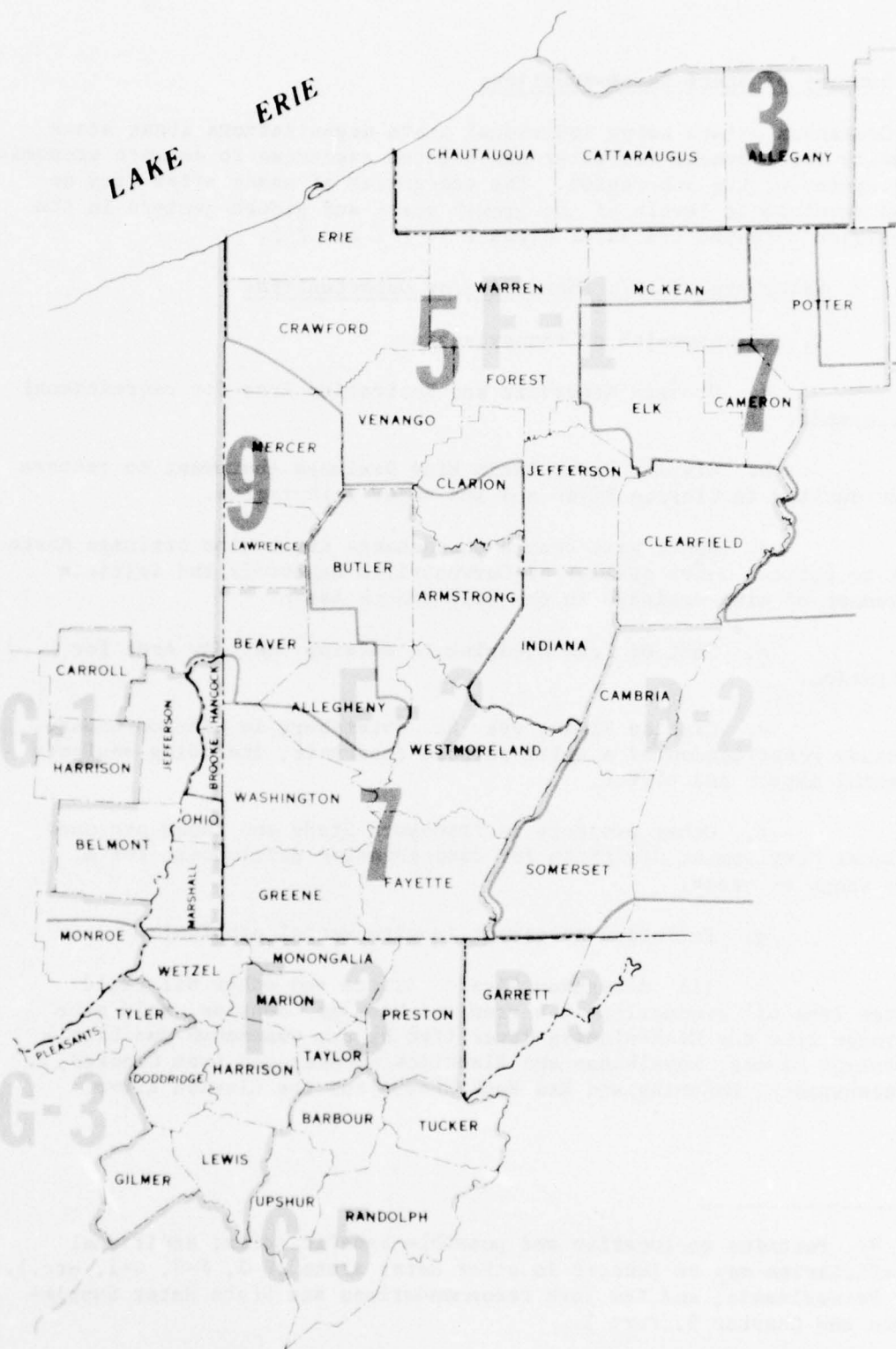
Development on larger amounts of riverfront industrial land indicates potential for canalization of the lower reaches of the major tributary streams, such as the Kiskiminitas and Youghiogheny Rivers, and probably others.

While population and employment rate increases appear to have leveled off in the Pittsburgh urban complex, production capacity, in relation to the total market, has steadily increased. The existing, modernized river navigation system in its central core maintains a large annual commercial tonnage. Navigation provides this major complex with a regional advantage, though competitively diminishing, of great significance with respect to sharing markets. Further, this sub-region's river transportation history reveals that this waterway system during time of military emergencies has been called upon to deliver vast tonnages with dispatch and utmost dependability.

Erie Harbor offers the sub-region contact with ports in all continents of the world. In eight-month usual operation, the port engages actively in export-import trade. The materials exported are products and raw materials manufactured and processed principally in the Erie urban complex. Development of the Port would enhance the sub-regional economy by promoting foreign trade from expansion and/or diversification of the existing industrial base. New terminal and transfer facilities and services for constructing and handling (for major overhaul and repair) the size and type of ship used on the Great Lakes and in overseas commercial fishing, could be adapted for enlarged usage by addition of required facilities. This would turn the entire lake-shore area in the Erie urban complex to new economic development, initiated by present plans for a boat-building industry. Within the time period of the benchmarks the principal markets for the products of the sub-region may depend on these lake ports for outlet into the Metropolitan belt.

Power

Power supply areas relevant to Sub-region F are shown on Figure 12-9. A discussion concerning electric power needs, probable future installation of generating capacity, and cooling water needs for the Appalachian Region, on a regional basis, is contained in Chapter 4 of Part I.



POWER SUPPLY AREAS

Summary of State Recommendations

Consensus exists among individual state organizations about state priority requirements for water and related resources to enhance economic development of the sub-region. The categories of needs arise from desired development levels of the growth areas and growth centers in the sub-region's respective Water Areas F-1, F-2 and F-3.

Water Area F-1*/: Needs and/or Opportunities

1. Commonwealth of Pennsylvania

- a. Otocsin Reservoir and Recreation Area for recreational development.
- b. Clarion River Basin Mine Drainage Abatement to restore water quality in Clarion River and its major tributaries.
- c. Upper West Branch Susquehanna River Mine Drainage Abatement to protect water quality of Curwensville Reservoir and initiate abatement of mine drainage in the West Branch Basin.
- d. Port of Erie Dredging to develop West Bay Area for navigation.
- e. Clarion River, near St. Petersburg in Clarion County, to study construction of a multi-purpose reservoir, including analysis of total impact and effect.
- f. Other projects in Framework Study and those proposed by local Development Districts for comprehensive development for a wide range of needs.
- g. Pollution abatement (environmental problem):
 - (1) Allegheny River: Brines and other oil field wastes from oil production in Warren and Venango Counties; acid mine drainage from the Kiskiminetas River (fed by the Conemaugh and Little Conemaugh Rivers, Loyalhanna and Blacklick Creeks) and from Crooked, Cowanshannock, Mahoning and Red Bank Creeks and the Clarion River.

*/ Pertains to location and possible beneficiaries; additional beneficiaries may be located in other water areas (F-2, F-3, G-1, etc.). For Pennsylvania, and New York recommendations see State Water Supplements and Chapter 9, Part I.

(2) Monongahela River: Acid mine drainage from small tributary streams from the West Fork River Basin, and from tributaries between Fairmont, West Virginia, and Pittsburgh; and organic wastes added throughout the entire industrial valley are part and parcel of a general sub-region problem affecting needs in Water Area F-1 (subsequently Water Areas F-2 and F-3).

(3) Beaver River: Domestic and industrial wastes causing hardness, acidity and thermal pollution are part and parcel of a general sub-region problem affecting needs in Water Area F-1 (subsequently to Water Areas F-2 and F-3).

h. General^{*/}

(1) Inhibitions to development at growth centers or causing damage to the existing economic base: flooding, pollution and lack of water supply.

(2) Future industrial development: Stream quality improvement, water damage prevention to make potential developable land "flood free."

(3) Other commercial potential: Establishment of navigation for a variety of business developments; recreation opportunities — service establishments for boating (commercial linkages that range from boat manufacturing to rigging), camping supplies, resorts, and other recreation industry firms.

(4) Water-related recreation, including fish, water fowl and other game conservation for sport.

(5) Water supply and quality (Water Purity and Clean Streams Act).

(6) Multiple-purpose water resources development: to achieve water quality control, prevent flooding, promote recreation, improve opportunities for industrial development, etc., as well as to buoy community economies.

2. State of New York

a. Genesee River, Stannard Dam and Reservoir, near Wellsville, New York, in Allegany County: multi-purpose project for navigation, recreation, water quality control, irrigation, water supply and industrial development.

^{*/} Also applicable to Water Area F-2 as 1.j.

b. Cattaraugus County, Otto Reservoir, near Gowanda, New York, multi-purpose project for flood control, recreation, and irrigation. Further studies should consider Springville Reservoir in combination with Otto.

c. Industrial water supply for the Southern Tier Counties; municipal supply for the Villages of Gowanda and Perrysburg in Cattaraugus County; irrigation supply for Chautauqua County and along the Genesee in Allegany County; groundwater supply for Chautauqua and water supply for Chautauqua County (Celeron and Jamestown treatment plants); and for economic growth.

d. Water damage prevention at Ischua Creek and Conewango Creek watersheds, Chautauqua Lake and Chadakoin River, local areas along the Allegheny River, Genesee River and Cattaraugus Creek.

e. Recreation and fish and wildlife at developmental sites listed in "2(a-b)" above and state parks, including boat launching and access sites.

f. Public boating facilities along the Lake Erie shores for recreational development; harbors of refuge with small boat facilities are needed.

g. Additional pumped storage facilities at a site in the vicinity of Westfield, New York; to be incorporated with a flood control and lake level control project for Lake Chautauqua.

h. Possible groundwater development (for economic development) in Chautauqua, and Cattaraugus Counties for industrial and municipal water supply.

Water Area F-2*/: Needs and/or Opportunities

1. Commonwealth of Pennsylvania

a. Sewickley Creek Watershed for flood protection and industrial water supply for industries between Greensburg and Youngwood. (Reference P.L. #566 project.)

b. Casselman River Mine Drainage Abatement to restore fish and aquatic life in the Casselman and Youghiogheny Rivers and to protect the recreational use of Ohiopyle State Park (and ultimately the entire Youghiogheny River Basin) (cross reference to Sub-region B report).

*/ Pertains to location and possible beneficiaries; additional beneficiaries may be located in other water areas (F-1, F-3, G-1, etc.)

c. Upper Casselman River, potential multiple-purpose reservoir. (Further locational and engineering study desired) (cross reference to Sub-region B report). (Coordination required between Pennsylvania and Maryland, SCS and C of E.)

d. Connoquenessing Creek Watershed for water damage prevention, water supply and recreation for West Central Butler County, including Butler and Zelinople, Pennsylvania. (SCS P.L. #566 project, and/or C of E multiple-purpose reservoirs).

e. Raccoon Creek, multi-purpose reservoir, adjacent to Raccoon Creek State Park, for water damage prevention, water quality, water supply, recreation (and economic development).

f. Big Sandy Creek, multi-purpose reservoir. (Further coordination needed on location and design of project, and possibility of joint development with the State of West Virginia.)

g. Upper Loyalhanna Creek Watershed for flood control, water supply and recreation, and eastern Westmoreland County, including Ligonier-Latrobe area. (P.L. #566 project.)

h. Stony Creek watershed for flood control and recreation for Hooversville and Bough, Pennsylvania, to alleviate annually recurring damage to railroad facilities. (P.L. #566 project.)

i. Other projects in Framework Study and others proposed by local development districts for comprehensive development for a wide range of needs.

j. (Same as Water Area F-1, item 1.h.)

Water Area F-3*/: Needs and/or Opportunities

1. State of West Virginia**/

a. Ohio River from the Pennsylvania/West Virginia state line to near the Marshall/Wetzel County Line:

/ Pertains to location and possible beneficiaries; additional beneficiaries may be located in other water areas (F-1, F-2, G-1, etc.). See Section VII for complete delineation of plan for sub-region.

**/ State needs are oriented toward economic development and water and related resources by State Regions (Regions 17 and 18 in Water Area F-3) rather than individual growth centers or projects. See West Virginia and Ohio recommendations in State Water Supplement and Chapter 9, Table 1.

(1) Problem of changing assimilative capacity of the river to changing environment caused by canalization.

(2) Pollution Abatement Program: Municipal wastes and industrial wastes (steel, chemical, and pottery). Corrective mine drainage action at pollution sources.

(3) Water damage prevention for economic development (industry, municipalities and other interests), including flood plain management.

(4) Recreational facilities:

(a) Wetzel County (New Martinsville) -- power boat launching site to include parking for vehicles with boat trailers, drinking water, sanitary toilet facilities and limited picnicking.

(5) Same as Water Area F-3, State of Ohio (item 2).

b. Upper Monongahela Valley Region (not including extreme headwater regions of the Monongahela: Cheat, Tygart and Little Kanawha Rivers) (Region 5).

(1) Water damage prevention.

(2) Residential and industrial (including acid mine drainage and municipal raw sewage) pollution abatement.

(3) Municipal and industrial water supply (glass and pottery, construction stone and sand, charcoal, coal, and ceramic clay).

(4) Recreational facilities (additional facilities to be developed in relation to pending, i.e., potential water resource developments).

(a) Monongalia County -- secure an additional power boat launching site.

(5) Land reclamations (strip-mine) (to be coordinated with planned, i.e., potential, water resource and recreation developments).

c. General:

(1) Future municipal and industrial water supply, with adequate volume and quality.

(2) Recreational facilities by development of waterways.

(3) Preservation of natural beauty of forests, lakes and streams.

(4) Preservation of ecological aspects of wildlife habitat (to reconcile water-oriented recreational resources and potential saturation of use).

(5) Water damage prevention:

(a) To include 11 P.L. #566 projects and flood regulation and zoning.

(6) "Broad water" recreational opportunities^{*/}, including state park complexes, day-use state parks, state recreation areas, public hunting areas, public fishing areas, "natural" or "wild river" segments, or existing, wilderness area, or existing and broad water areas. This applies in varying degrees to both Regions 4 and 5. Desirably, each region will have one broad water recreation complex, created, designed and managed for year-round recreational services (Policy of minimum drawdown by Corps of Engineers on existing and potential reservoirs desired).

(a) State-wide recreation plan to consider Corps of Engineers reservoir sites, existing and proposed, to select the reservoir site which has: (1) the most developable land in relation to the water, and (2) the best recreation water quality. The reservoir in each state region which best meets these qualifications will be planned for development as its major broad water recreation complex site. The selected site will have: (1) maximum recreation benefits credited to its construction, and (2) a water management plan which required minimum drawdown fluctuation. Other reservoirs will have day-use developments appropriate for their land-water capability and designated role of service. Drawdown problem at Tygart Lake State Park causes a short recreation season due to mud flats (indication of need -- supplementation of Tygart storage by upstream reservoirs).

d. Headwater Upper Monongahela Valley Region and Cheat River Region:

(1) Existing Tygart Lake -- minimize extreme drawdown and extend the user season.

(2) Authorized Stonewall Jackson Lake -- acquire suitable land to develop primarily for day use; also hunting and fishing.

^{*/} A "broad water recreation complex" is one offering comprehensive recreation opportunities in, upon, and around a body of water.

(3) Authorized Rowlesburg Reservoir -- acquire suitable land, and mitigate fish and wildlife losses. Develop primarily for day use and camping. Complement the natural and primitive theme of the Monongahela National Forest. Encourage overnight lodging investment by the private sector near Parsons. The state will manage fish and wildlife only. U.S. Forest Service to develop and maintain the recreation facilities.

(4) Big Sandy Creek, multiple-purpose reservoir. (See Water Area F-2, item 1.f.)

(5) Upper Tygart River, multiple-purpose reservoir.

(6) Buckhannon River, multiple-purpose reservoir.

(7) Middle Fork River, multiple-purpose reservoir.

e. Little Kanawha Region:

(1) Leading Creek Lake.

2. State of Ohio

a. Water supply and water quality along the main stem of the Ohio river and its direct tributaries.

b. Local water damage prevention at main stem Ohio River communities, including flood plain management along the entire river waterfront with economic development.

c. Reclamation of "pre-law" strip mine spoil banks.

d. (Same as Water Area F-3, W. Va., item 1.a.)

8. WATER RESOURCE NEEDS BY RIVER BASINS

Regional, Primary and Secondary Growth Centers

Water needs for the sub-region's economic development objectives are derived from analysis of benchmark population and employment projections, disaggregated to the state planning sub-regions. However, for principal cities and other important growth localities, more detailed economic and corresponding water needs considerations have been utilized. This was done because there is sufficient valid commonality between these economic development areas and their river basin envelopments for developmental trends in the latter to be reflected in the basin. This procedure facilitated specific investigation of directly pertinent water needs. The more detailed examination of water needs for the smaller planning units permitted evaluation of water supplies in the major hydrologic areas and the needs of their

associated economic activity areas. Objectives have already been discussed in detail for the growth centers from the standpoint of broadly considered qualitative and quantitative water needs. Consequently, the following gross needs description by river basins completed the analysis sufficiently for: (1) a sub-regional framework list of presently indicated most needed water resource alternatives, and (2) a plan to implement such alternatives for satisfaction of immediate and long-term needs. These follow in Sections III and IV.

For brevity, the following discussion and tables relate the most immediate and longer-term critically important needs for the major established economic activity areas to their principal, more dominant growth centers by major river basins, including Lake Erie.

River Basin - Economic Areal Correlation

Correlation relates the needs of the sub-region's four regional growth centers, twelve primary growth centers and thirteen secondary growth centers to appropriate portions of the Lake Erie, Cattaraugus Creek, Little Kanawha and Genesee River Basins, and the major Ohio River tributary areas involving the Allegheny, Monongahela and Beaver River Basins. These basins are divided into smaller subdivisions*/ which include significant area beyond the limits of existing reservoirs and local flood protection projects where local flood conditions and water deficiencies generate a comprehensive need. This integration provides the Allegheny River with five subdivisions; the Monongahela River with five subdivisions; two subdivisions for the Beaver River; one subdivision for the upper Ohio River; two subdivisions for the Lake Erie drainage portion of Sub-region F; and one each for the portions of the Genesee, Susquehanna and Little Kanawha River Basins contained in Sub-region F.

For all river basins, acceleration of the U. S. Department of Agriculture's various programs for conservation, development and proper land use is urgently needed. Details are given in Appendix A - Agriculture, Forestry and Conservation to the Main Report.

For location of features by subdivision discussed in the following sections see: Figures 12-21 and 12-22 for Allegheny River Basin; 12-31 for Monongahela River Basin and portion of Little Kanawha Basin; 12-35 for Beaver and Upper Ohio Basins; and 12-48 for Lake Erie and Genesee Basins, all in Section IV of this chapter.

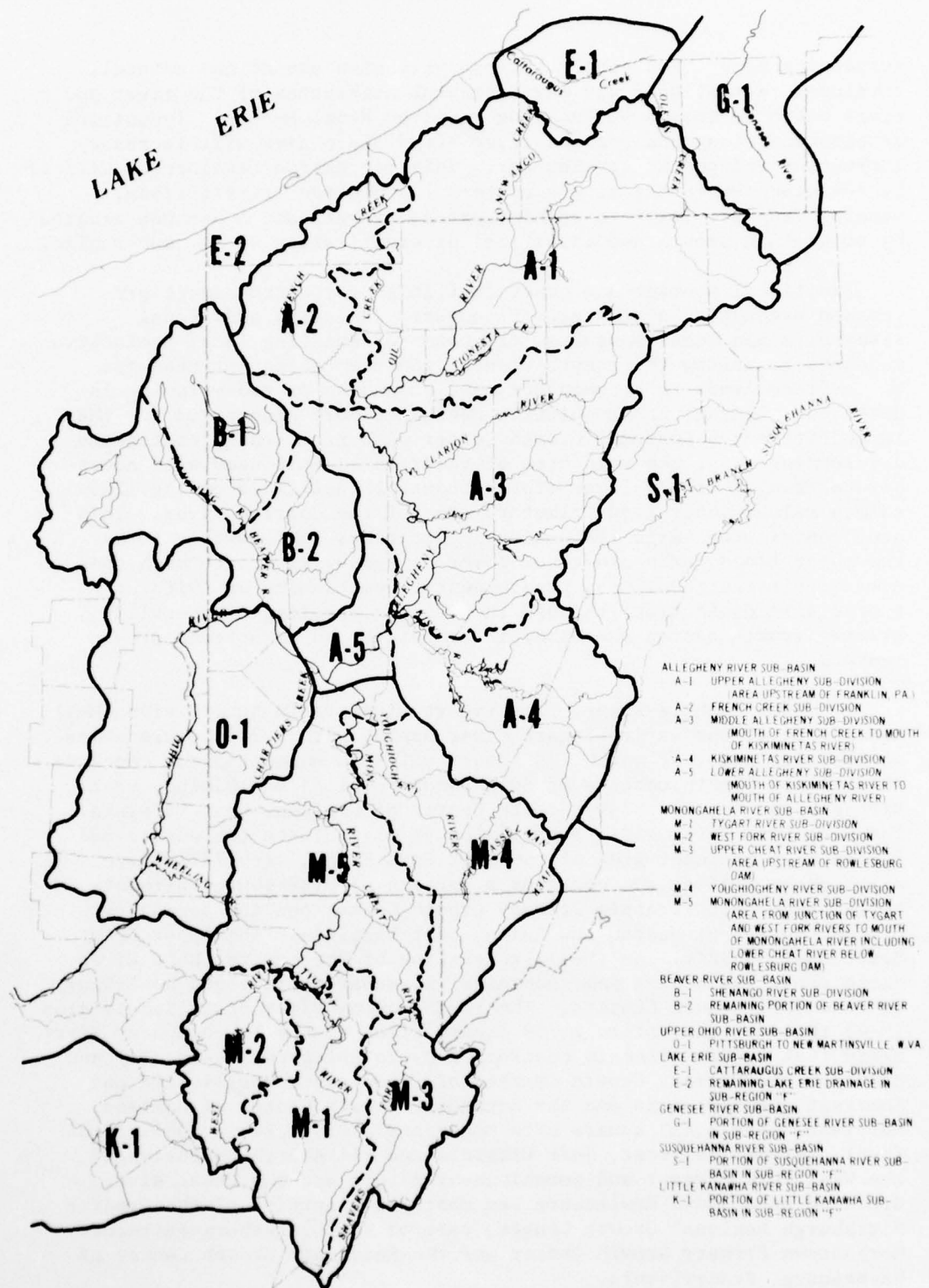
Allegheny River. The upper Allegheny River Basin Subdivision (A-1) includes the primary growth centers of Jamestown, New York - Warren, Pennsylvania, and Olean, New York - Bradford, Pennsylvania and the secondary growth centers of Coudersport, Pennsylvania, Franklinville, New York and Oil City - Franklin, Pennsylvania. These are all located in the area upstream of Franklin, Pennsylvania, which has a drainage area of 4,725 square miles, 2,067 square miles of which, below

*/ See Figure 12-10.

Allegheny and Tionesta Reservoirs, is uncontrolled. The Meadville, Pennsylvania primary growth center is located within the French Creek Subdivision (A-2), comprising all of the French Creek Basin which enters the Allegheny River at Franklin, and which has a drainage area of 1,235 square miles, of which 906 square miles below Woodcock, Muddy Creek and Union City Reservoirs, is uncontrolled. The Middle-Allegheny River Subdivision (A-3) contains the primary growth centers of Ridgway - St. Marys, Pennsylvania, DuBois - Clearfield, Pennsylvania and Kittanning - Ford City, Pennsylvania and the secondary growth centers of Clarion and Punxsutawney, Pennsylvania. This area, between the mouth of French Creek and the mouth of the Kiskiminetas River, has a drainage area of 3,391 square miles, of which 2,702 square miles below Crooked Creek, Mahoning Creek and East Branch Clarion Reservoirs, is uncontrolled. The Kiskiminetas River Basin Subdivision (A-4), containing part of the Regional Growth Center of Johnstown-Altoona and the Primary Growth Center of Indiana, Pennsylvania, comprises all of the Kiskiminetas River Basin with a total drainage area of 1,887 square miles. The Lower Allegheny River Basin Subdivision (A-5) contains an uncontrolled drainage area of 495 square miles, from the mouth of the Kiskiminetas River to the mouth of the Allegheny River, and is located within the Regional Growth Center of Pittsburgh.

Water supply from the main stem of the Allegheny River appears to be ample at all of the above growth centers to 1980. However, need for development of either or both water storage and conveyance systems appears beyond 1980, as increases in population and employment are more keenly felt, and as the industrial base expands. Growth centers in this basin and downstream can continue to extract water from the main stem of the river, if there is no further decline in water quality, with progressive expansion of treatment and distribution facilities as population and employment increase. Growth centers in the tributary areas, particularly those dependent upon groundwater supplies, may experience difficulty in expanding these facilities and may need supplementation from good quality surface sources. Consequently, more comprehensive existing reservoir use will also be required to accommodate growing water supply demands and recreation pressures.

Allegheny Reservoir, the Allegheny National Forest and related and adjacent recreational developments, with continued facility development, will relieve sub-region recreation pressure until 1980. Beyond 1980, other extensive developments, now potential, principally St. Petersburg Reservoir on the Clarion River, will be sorely needed. Water quality problems are critical, in the downstream growth centers and below industrial concentrations in the headwater growth centers, as pollution accumulates from the headwater areas and is augmented by wastes from the more heavily developed downstream growth centers. Storage and regulation facilities for dilution water are needed. Here again, the St. Petersburg Reservoir Project offers possibilities.



SUB-DIVISIONS

Burgeoning population concentrations will make use of the natural, developed recreational and environmental attributes of the river and river basin to form a nucleus for required developments. Industrial development along and off the river flood plain area will increase recreation and scenic development. This recreation development will be advantageous to the growth centers and provide satisfactions, ranging from primitive to sophisticated, of recreation demands created by population growth and industrial diversification of the sub-region.

Additional storage and other facilities for water damage prevention are needed at the growth centers, including additional reservoirs and local measures, extension of existing local protective measures to follow the growth trends, and the consequent need for flood-freed lands to accommodate new, expanding or redeveloping industries. Storage and regulation needs are more pronounced for the large Pittsburgh Regional Growth Center with practically contiguous development along the main stem of the river. This need will necessitate development of large storage control facilities on the 1245 square mile uncontrolled tributary area of the Clarion River. This area contributes large residual concentrations to flow that forms the major flood peaks along the lower Allegheny River, through the Greater Pittsburgh primary growth center, continuing on (without appreciable diminution) through the Greater Wheeling-Steubenville primary growth center and other intermediate and downstream growth centers.

Monongahela River. The Tygart River Basin Subdivision (M-1) consisting of the entire Tygart River Basin, with 1,374 square miles of drainage area, of which 190 square miles is uncontrolled, contains the Primary Growth Centers of Buckhannon-Philippi and Elkins, West Virginia and the Secondary Growth Center of Grafton, West Virginia. The West Fork River Basin Subdivision (M-2) includes the entire 881 square mile drainage area of the West Fork River, with 771 square miles uncontrolled, and contains a portion of Clarksburg-Fairmont-Morgantown, West Virginia Primary Growth Center and the Secondary Growth Centers of Weston and Salem, West Virginia. The Upper Cheat River Basin Subdivision (M-3), consisting of the entire Cheat River Basin above Rowlesburg Dam, contains 926 square miles, and no Primary or Secondary Growth Centers. The Youghiogheny River Basin Subdivision (M-4) includes the entire 1,768 square miles of the Youghiogheny River Basin (434 square miles is controlled by Youghiogheny Reservoir) and contains the Primary Growth Centers of Uniontown-Connellsville and Somerset, Pennsylvania and the Secondary Growth Center of Oakland, Maryland. The 2,419 square mile Monongahela River Basin Subdivision (M-5), between Fairmont, West Virginia and Pittsburgh exclusive of the West Fork, Tygart and Youghiogheny Rivers and the Cheat River drainage area above Rowlesburg Dam contains a portion of the Greater Pittsburgh Regional Growth Center, part of the Clarksburg-Fairmont-Morgantown Primary Growth Center and the Secondary Growth Center of Waynesburg, Pennsylvania.

Water quality, water supply, and flood control are paramount growth center needs in many areas throughout the Monongahela River Basin. Beyond 1980, quality control measures probably will require sufficient surface storage and regulation for dilution water to maintain better than marginal water quality.

Primary Growth Centers at Buckhannon-Philippi, Eikins, Uniontown-Connellsville, and Oakland along the main stems of the larger tributary streams, will require additional water supply and flood protection beyond 1980. Upstream watershed protection measures will be required to augment the larger storage reservoirs which can be located on Big Sandy Creek, Dunkard Creek and Laurel Hill Creek. Upstream water resource investments, for headwater growth centers, will have to be augmented by downstream developments to service the downstream communities as growth increases.

The rugged topography and associated scenic environment of the Monongahela River Basin, in its headwater areas especially, could supply recreation needs of the sub-region. Water supply developments above Tygart and Youghiogheny River Reservoirs will be required to obtain recreation pool levels permitting more comprehensive recreational use.

Beaver River. The Shenango River Basin Subdivision (B-1) consists of the entire Shenango River Basin drainage area (1,070 square miles, 481 square miles uncontrolled) and contains a portion of the New Castle-Sharon-Meadville, Pennsylvania Primary Growth Center. The Beaver River Basin Subdivision (B-2), (948 square miles) is the area between the mouth and head of the Beaver River, at the junction of the Mahoning and Shenango Rivers. This subdivision contains portions of the Greater Pittsburgh Regional Growth Center and the New Castle-Sharon-Meadville Primary Growth Center.

Flood control needs, in the Shenango River Basin, beyond 1980 are not great. Future land site developments at New Castle and other locations along the river mainstem in the Sharon-New Castle primary growth center and downstream will probably require flood protection to accommodate projected employment and population increases.

Severe thermal pollution problems from upstream watershed industrial concentrations appear to cause the major need for additional storage capacity and regulation in the Sharon-New Castle growth center to maintain acceptable water quality.

Population and employment increases and diversification and expansion of industry throughout the valley will also require future pollution amelioration and additional water supply.

New scenic and recreational opportunities are needed to augment the sub-region supply and to reduce recreation pressure on existing headwater reservoir developments. Preservation of existing scenic areas of outstanding character will be required to enhance the latter potential.

Ohio River. The Upper Ohio River Subdivision (O-1) consists of the area between the river head at Pittsburgh and the lower end of the Pittsburgh Engineer District, Ohio River mile 127.2, excluding the Beaver River Basin. This subdivision contains the Steubenville-Wheeling and part of the Greater Pittsburgh Regional Growth Centers and the Secondary Growth Center of West Union, West Virginia.

Flood protection is needed for potential riverbank land-use, also water quality control, and in-stream recreation and environmental enhancement are needed along this portion of the Ohio River. Water supply from the river is ample, although there is considerable range in quality related to the distance below and between major industrial concentrations and developments. Storage and regulation upstream of dilution water will be needed to maintain minimal quality standards through and below the Greater Pittsburgh Region, to induce needed redevelopment of sites on which outmoded facilities will exist by 1980 and to aid in development of vacant land sites. Flood plain management studies are expected to be completed by 1980.

In the Allegheny and Monongahela River Basins, additional large upstream storage and regulation reservoirs will be required to induce and support economic development possibilities. Reservoirs of the effective size of St. Petersburg, Big Sandy Creek, Dunkard Creek and Laurel Hill Creek will be needed to contain runoff concentrations, so that flood damages can be materially reduced at the dominant growth centers located along the mainstem of the Ohio River.

In-stream recreation possibilities along the river will generate needs for improved water quality, provision of boating and fishing facilities, and miscellaneous facilities to satisfy increasing recreation demand on the area. As upstream watershed growth areas on direct draining streams to the Ohio River develop increased population and employment, water investments for flood protection, water supply and recreation will be needed. This will probably occur at areas tributary to the Ohio River, in and between the Greater Pittsburgh and the Greater Wheeling-Steubenville primary growth centers.

Lake Erie. The Cattaraugus Creek Basin (E-1) consists of the entire Cattaraugus Creek drainage area of 560 square miles, and contains the Secondary Growth Center of Gowanda, New York. The Lake Erie Subdivision (E-2) consists of the remaining direct Lake Erie drainage area in Sub-region F of 1,301 square miles, and contains the Regional Growth Center of Erie-Lake Erie.

The Erie-Lake Erie Primary Growth Center will require water quality improvements and increased water supply for its projected regional population and employment.

The secondary growth center at Gowanda, New York, and the agricultural area downstream, will require flood protection and increased water quality and water supply through multiple-purpose reservoir storage, local measures, or a combination of both. Flood control measures are also presently required at Conneautville, Pa.

Extensive industrial land development potentials bordering Lake Erie require installation of additional commercial port facilities at Erie and Dunkirk by 1980, improvements of existing facilities, and development of supplementary commercial ports along the intermediate lakeshore augmenting excellent railroad and highway transportation. The water-oriented recreation need in the Erie-Lake Erie primary growth center will require modification of the authorized chain of small-boat harbors for larger cruising recreational craft, to accommodate smaller cruising craft and to provide a base for local boats. Water quality improvements are needed to augment large and small boat navigation and recreational fishing improvements at Lake Erie State Park and other adjacent locations along the lake shore. Substantial projected increases in population and employment will require full development of lake associated recreation possibilities in the strip-area bordering Lake Erie extending through Cleveland to Buffalo and lake-type recreation at off-lake sites. Beach erosion needs met by 1980 will leave only residual needs related to future recreational and industrial lake shore developments. Power needs for the contiguous areas throughout this and adjacent growth centers require consideration of hydropower peaking power possibilities from developments on Lake Erie - Niagara River and the nearby Genesee and Allegheny River Basins.

Genesee-Susquehanna and Little Kanawha Rivers. The remainder of the sub-region consists of headwater areas of the Genesee (G-1) Susquehanna (S-1) and Little Kanawha Rivers (K-1) with drainage areas of 930, 2,443 and 616 square miles respectively. The Genesee portion contains part of the Hornell-Wellsville Primary Growth Center, the Susquehanna portion contains the Emporium Secondary Growth Center, and the Little Kanawha portion contains the Glenville Secondary Growth Center.

Upper watershed areas of the Susquehanna (West Branch above Currensville Reservoir) and Little Kanawha Rivers will require water quality improvement to accommodate growth at Clearfield, Pennsylvania (primary), and Glenville, West Virginia (secondary) growth centers. There are needs for storage and regulation for low flow augmentation and for control measures. Emporium is the center of growth, in Cameron County, which presently enjoys one of the highest per capita incomes in the sub-region, little unemployment, and a fair potential for growth.

Water transfer may be needed for water supply. Recreation in the Susquehanna River headwater area at Otocsin, connected to the east and west by Interstate Route 80, offers possibilities for relieving sub-region recreation demand pressure. The Genesee River headwater area could offer similar recreation possibilities by potential multi-purpose reservoir at the Stannard site. This reservoir could supply multiple-purpose water goods and services to the Wellsville primary growth center for current and future needs.

Summary

The following Corps of Engineers Tables contain estimated (net) water and related resource needs to support the growth centers' benchmarks.

TABLE 12-21
FLOOD CONTROL NEEDS AND RESIDUAL DAMAGES BY GROWTH CENTERS
WATER SUB-REGION F (\$1,000)

GROWTH CENTER	STREAM	ESTIMATED ANNUAL AVERAGE WATER DAMAGES (\$1,000)	REDUCTION BY ALTERNATIVES STUDIED FOR AGRS (\$1,000)	RESIDUAL DAMAGES (\$1,000)	EFFECTIVE PROJECTS
GENESSEE RIVER BASIN					
Wellsville, N. Y.	Genesee River	24	18	6	Stannard Reservoir & Local Protection
LAKE ERIE					
Erie - Lake Erie, Pa. - N. Y.	Lake Erie Cattaraugus Creek Conneaut Creek	31 16	27 12	4 4	Local Protection 1/ "
ALLEGHENY RIVER BASIN					
Jamestown - Warren, N. Y. - Pa. Olean - Bradford, N. Y. - Pa. Franklinville, N. Y. Coudersport, Pa. Herdville, Pa. Franklin - Oil City, Pa. Kidgway - St. Marys, Pa. Emporium, Pa. DuBois - Clearfield, Pa. Clarion, Pa. Punxsutawney, Pa. Kittanning - Ford City, Pa. Indiana, Pa. Johnstown, Pa.	Chadakoin River - Conewango Creek Allegheny River French Creek Allegheny River - French Creek Clarion River - Elk Creek Sinnebohoning Creek Little Sandy Creek Clarion River Mahoning Creek Allegheny River Stoney Creek - Little Conemaugh River	700 - - 300 5 - 5 2/ - 38 - 30	470 - - 300 - - - - 47 - -	230 - - - 5 - 5 - 11 - -	Local Protection - - Local Protection - - - - St. Petersburg Reservoir - -
MONONGAHELA RIVER BASIN					
Elkins - Buckhannon - Philippi, W. Va. Weston - Glenville, W. Va. Clarksburg - Fairmont - Morgantown, W. Va. Grafton, W. Va. Oakland, Md. Uniontown - Connellsville, Pa. Waynesburg, Pa.	Tygart River, Buckhannon River West Fork West Fork, Monongahela River Tygart River Little Youghiogheny River Redstone Creek - Youghiogheny River Ten Mile Creek	12 - 193 - - 562 -	12 - 142 - - 112 -	- - 51 - - - -	Upper Tygart, Middle Fork and Buckhannon River Reservoir - Hackers Creek - Freemans Creek and Kinchloe Creek Reservoir - Local Protection -
BEAVER RIVER BASIN					
Sharon - New Castle, Pa.	Shenango River	20	-	20	-
OHIO RIVER MAIN STEM					
Greater Pittsburgh, Pa.	Monongahela and Allegheny River	995	939	56	St. Petersburg, Dunkard Creek, Big Sandy Creek, Laurel Hill Creek Reservoir
Wheeling - Steubenville, W. Va. - Ohio	Ohio River	804 3,372	710 3,124	94 248	St. Petersburg, Dunkard Creek, Big Sandy Creek, Laurel Hill Creek Reservoir

1/ Multiple Purpose Reservoirs now under study.
2/ DuBois only.

TABLE 12-22
LAND DEVELOPMENT NEEDS
WATER SUB-REGION F

GROWTH CENTER	URBAN LAND NEEDS ^{1/}	
	TOTAL ACRES	FLOOD PLAIN ACRES
<u>GENESEE RIVER BASIN</u>		
Wellsville, N.Y.	2,420	100
<u>LAKE ERIE</u>		
Erie - Lake Erie, Pa. - N.Y.	15,600	---
Gowanda, N.Y.	3,600	150
<u>ALLEGHENY RIVER BASIN</u>		
Jamestown - Warren, N.Y. - Pa.	9,230	600
Olean - Bradford, N.Y. - Pa.	11,440	---
Franklinville, N.Y.	1,800	---
Coudersport, Pa.	810	---
Meadville, Pa.	1,940	150
Franklin - Oil City	2,050	50
Ridgway - St. Marys	2,490	---
Emporium, Pa.	270	---
DuBois - Clearfield, Pa.	6,400	50
Clarion, Pa.	1,480	---
Punxsutawney, Pa.	1,020	---
Kittanning - Ford City, Pa.	6,290	100
Indiana, Pa.	4,780	---
Johnstown, Pa.	1,670	300

^{1/}Additional over 1967 use.

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DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. MAIN REPORT. PART--ETC(U)

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TABLE 12-22
LAND DEVELOPMENT NEEDS
WATER SUB-REGION F
(CONTINUED)

GROWTH CENTERS	URBAN LAND NEEDS	
	TOTAL ACRES	FLOOD PLAIN ACRES
<u>MONONGAHELA RIVER BASIN</u>		
Elkins - Buckhannon - Philippi, W. Va.	650	200
Weston - Glenville, W. Va.	350	---
Clarksburg - Fairmont - Morgantown	8,340	300
Grafton, W. Va.	220	---
Oakland, Md.	600	---
Somerset, Pa.	1,320	---
Uniontown - Connellsville, Pa.	5,330	150
Waynesburg, Pa.	2,090	---
<u>BEAVER RIVER BASIN</u>		
Sharon - New Castle, Pa.	6,860	150
<u>OHIO RIVER MAIN STEM</u>		
Greater Pittsburgh, Pa.	148,500	1,000
Greater Wheeling - Steubenville	5,850	2,000

TABLE 12-23
WATER SUPPLY REQUIREMENTS
WATER SUB-REGION F

GROWTH CENTER	GROSS DEMAND			DEPENDABLE SUPPLY (MGD)	2020 UNMET NEEDS
	1980 (MGD)	2000 (MGD)	2020 (MGD)		(MGD)
<u>GENESEE RIVER BASIN</u>					
Wellsville, N. Y.	9	11	13	4	9
<u>LAKE ERIE</u>					
Erie - Lake Erie, Pa., N. Y.	97	290	482	482+	--
Gowanda, N. Y.	4	12	20	5	15
<u>ALLEGHENY RIVER BASIN</u>					
Jamestown - Warren, N. Y. - Pa.	20	100	180	22	158
Olean - Bradford, N. Y., Pa.	12	45	80	14	66
Franklinville, N. Y.	1	4	10	1	9
Coudersport, Pa.	1	2	4	1	3
Meadville, Pa.	12	50	100	13	87
Franklin - Oil City, Pa.	18	25	32	32+	--
Ridgway - St. Marys, Pa.	5	30	50	6	44
Emporium, Pa.	1	2	4	1	3
DuBois - Clearfield, Pa.	9	50	100	10	90
Clarion, Pa.	1	5	12	2	10
Punxsutawney, Pa.	2	4	6	6	--
Kittanning - Ford City, Pa.	35	230	450	450+	--
Indiana, Pa.	4	30	70	5	65
Johnstown, Pa.	12	200	470	320	150

TABLE 12-23
WATER SUPPLY REQUIREMENTS
WATER SUB-REGION F
(CONTINUED)

GROWTH CENTER	GROSS DEMAND			DEPENDABLE SUPPLY (MGD)	2020 UNMET NEEDS (MGD)
	1980 (MGD)	2000 (MGD)	2020 (MGD)		
<u>MONONGAHELA RIVER BASIN</u>					
Elkins - Buckhannon - Philippi, W. Va.	5	25	50	6	44
Weston - Glenville, W Va.	1	2	4	4	--
Clarksburg - Fairmont - Morgantown, W Va.	10	40	90	5 <u>1/</u>	30 <u>1/</u>
Grafton, W Va.	1	2	5	5+	--
Oakland, Md.	1	2	5	4	1
Somerset, Pa.	2	50	80	5	75
Uniontown - Connellsville, Pa.	12	70	130	130+	--
Waynesburg, Pa.	1	2	7	2	5
<u>BEAVER RIVER BASIN</u>					
Sharon - New Castle, Pa.	90	210	350	350+	--
<u>OHIO MAIN STEM</u>					
Wheeling - Steubenville, W. Va.	400	600	1040	1040+	--
Greater Pittsburgh	2000	3000	4669	4669+	--
West Union, W. Va.	1	2	3	1	2

1/ Clarksburg only. Fairmont and Morgantown have sufficient supply.

TABLE 12-24
ESTIMATED WATER AND RELATED RESOURCE NEEDS TO SUPPORT
GROWTH CENTERS IN SUB-REGION F

RIVER BASIN GROWTH CENTER	RIVER BASIN SUBDIVISION	ESTIMATED ANNUAL FLOOD 1/ DAMAGE (\$1,000)	AREAS NEEDING FLOOD PROTECTION (ACRES)	ADDITIONAL WATER SUPPLY 2020 (MGD)	WATER QUALITY ADDITIONAL STREAM FLOW 5 CFS	WATER BASED REPLETION DAYS 2020 (1,000's)
GENESSEE RIVER BASIN						
Wellsville, N.Y.	G-1	24	100	10	-	2,000
LAKE ERIE						
Erie - Lake Erie, Pa. - N.Y. Gowanda, N.Y.	E-2 E-1	- 31	- 150	- 15	- 140	35,000 2,200
ALLEGHENY RIVER BASIN						
Johnstown - Warren, N.Y. - Pa. Olean - Bradford, N.Y. - Pa. Franklinville, N.Y. Conduitsport, Pa. Meadville, Pa. Pittsburgh, Pa. Ridgway, St. Marys, Pa. Emporium, Pa. DuBois - Clearfield, Pa. Clarion, Pa. Punxsutawney, Pa. Kittanning - Ford City, Pa. Indiana, Pa. Johnstown, Pa.	A-1 A-1 A-1 A-2 A-1 A-1 S-1 A-3, S-1 A-3 A-3 A-4 A-4	47** - - 300** - 5 - 5 - - 58 - 30	600 - - 200** 20 - - 50 - - 1000 - 300	138 66 9 87 44 3 90 10 - 65 150	185 55 - 40 25 - - - 72 -	11,000 13,000 1,100 10,000 3,400 3,000 457 6,000 2,000 1,150 9,000 6,000 31,000
MONONGAHEIA RIVER BASIN						
Elkins - Buckhannon - Philippi, W. Va. Hescon - Glenville, W. Va. Clarksburg - Fairmont - Morgantown, W. Va. Grafton, W. Va. Oakland, Md. Somerset, Pa. Uniontown - Connellsville, Pa. Waynesburg, Pa.	M-1 M-2, K-1 M-2, M-5 M-1 M-4 M-4, M-5 M-5	12 - 193 - - 562 -	200 - 300 - - 650 -	44 - 33 1/2 - 1 75 5	30 - 453 - - 200 -	2,000 580 15,000 7,000 5,000 10,000 2,500
BEAVER RIVER BASIN						
Sharon - New Castle, Pa.	B-1	101	650	-	-	21,000
OHIO MAIN STEM						
Greater Pittsburgh, Pa. Greater Wheeling - Steubenville, W. Va. - Ohio	A-4, A-5, B-2, M-4, M-5, O-1	995 2/ 80	4,000 2,000	- 862	1,200 -	251,000 28,000
Totals		3,826	5,300			479,529
Totals for Sub-region F		12,000	10,000	1,280		571,100

1/ 1980 Degree of Water Damage Protection, 1969 Dollar Value and Development

2/ Allegheny River Portion - \$185,000
Monongahela River Portion - \$194,000
Ohio River Portion - \$406,000

3/ Clarksburg only.

* Assuming watershed project not completed by 1980. Damages = \$706,000
** Within corporate limits of Meadville (flood damages not included)

SECTION III - ALTERNATIVES FOR MEETING NEEDS

9. LATITUDE FOR SELECTION

For maximum economic effect, alternatives were selected by major river basins (and their subdivisions) to be flexibly responsive to the multiple-purpose requirements of the water areas, OBE economic sub-regions, and growth centers of Sub-region F*/ and contiguous Water Sub-regions B, G and H. A summary of the structural and non-structural alternatives (and corresponding needs for which they are intended) forming the elements of the sub-regional water resource plan is made in Figure 12-11 through Figure 12-48, in Section IV. See also Figure 12-50 WATER RESOURCES PLAN OF DEVELOPMENT, SUB-REGION F.

The alternatives offer the necessary facilities and programs to serve the expressed public**/ desire for water and related resource development best suited to achieve economic growth vital to the sub-region's individual and regional growth points. These are not unlike facilities and programs in existence by 1980, and generally reflect the need (or the lack of need) for additional improvements to provide: water and flood damage reduction by reservoir storage, channel improvements (including levees, floodwalls, diversion channels), flood plain management (including zoning, insurance, flood proofing, redevelopment, flood warning, and relocation), watershed impoundments, land treatment, water supply for municipal and industrial use, navigation, irrigation and other uses from surface and subsurface sources (including reservation of good quality sources for future use), water quality maintenance by treatment and pollution control measures, including acid mine drainage abatement, diversion, dilution or abatement of pollution of the water supply sources, and supplementation or modification of existing projects and programs to effectively supply all needs for water and related resource development. Other factors that influence selection are structural and non-structural recreation measures (water-oriented and water-associated) for: open-space; national and state fish, wildlife and forest area possibilities and enhancements; ecological, environmental and amenity improvement; in-stream and streambank improvements (including navigation pool use); associated scenic highway and agricultural land improvements for access to and use of areas not readily accessible; and scenic streambank and scenic stream-corridor reservation and use. Hydropower possibilities from run-of-river generation (navigation and reservoir structures and pumped storage are included where relevant. Navigation improvements considered include construction of

*/ See Table 11-11, Section II, Chapter 11.

**/ State Water Supplements and Investment Plans and other miscellaneous data.

new, replacement of old, and modernization of existing structures and systems for commercial navigation and economic development. Figure 12-10 shows river basin and river basin subdivision location and delineation, and place the following discussion of these water resource framework alternatives into sub-regional perspective and interrelation. The potential of these alternatives, whether used singly or in combination to service the growth points, is discussed below. The alternatives, analyzed within the benchmark framework, project a more diversified economic base throughout the sub-region (including more service-type possibilities) incorporating high technology and high growth industries with possibilities for expansion of industrial research. Water and related resources alternatives are not expected alone to underwrite the success of the sub-region, they are necessary to the creation of developmental possibilities in the metropolitan areas and their environs.

10. FRAMEWORK STUDIES OF ALTERNATIVES

General

After establishing the present and projected needs which must be satisfied in order to stimulate economic growth in Sub-region F, available alternative plans for meeting the projected water resource needs were developed. Preliminary plans were developed for special problem areas, for special purposes and for basin and region-wide multiple-purpose coverage. In the paragraphs immediately following, an analysis and comparison of the types of solutions available is made indicating in general terms the elements required in any water resources development plan for Water Sub-region F.

Water Damage Prevention

Detailed consideration of local flood protection measures such as levees, flood walls and/or channel improvements were considered as a possibility for meeting the water damage prevention needs of the sub-region. These investigations indicated that such local protection projects may be satisfactory in certain areas, but that projects of this type which would be of sufficient magnitude to provide an acceptable level of protection for the entire sub-region would not be economically feasible.

A further alternative considered was the possibility that suitable industrial sites could be developed by filling valley lands above flood heights; however, this method is not practicable for general use. While in some instance it might be an economically feasible means for protecting against floods, it contributes little to the fulfillment of other needed water services. Land filling on a large scale would result in severe damages to adjacent owners and to many other community interests.

Alternative measures for water damage prevention such as flood plain management and flood forecasting were also considered in assessing available alternatives. These measures would do much to reduce water damage, and should be used in conjunction with flood control and multiple-purpose reservoirs to provide the maximum possible degree of protection.

Water Supply

The two principal solutions for those areas in the sub-region with water supply problems are the development of groundwater sources where available in sufficient quantity and the reservoir storage of surface water. In those areas where groundwater supplies are insufficient to meet the needs or development of groundwater sources in sufficient quantity is too costly, the possibility of allotting storage for water supply in nearby reservoirs should be considered as a possible solution. Groundwater is available in varying degrees throughout the sub-region as is indicated in Figure 11-14 of Chapter 11. A well field capable of producing 1 mgd would cost between 4 and 25 thousand dollars throughout most of the sub-region except in the northeast and southern parts where the costs would be between 25 and 100 thousand dollars. The cost of the producing groundwater, based upon 1 mgd and including pumping costs, construction costs and interest for a 25-year period on construction costs, for raw water delivered at the well head would cost less than \$0.05 per thousand gallons throughout most of the sub-region except the north-central part where the cost would be between \$0.05 and \$0.25 per thousand gallons and the southwestern part of the sub-region where the cost would be greater than \$0.25 per thousand gallons. The optimum development of groundwater at these costs would be between 250 and 500 thousand gallons per day per square mile, along the Allegheny River where it would be more than 500 thousand gallons per day per square mile and in the northeastern part where it would be less than 25 thousand gallons per day per square mile.

Water Quality

Extensive areas of Sub-region F have water quality problems at the present time and this problem is expected to increase greatly in the future. Possible solutions to residual water quality problems include:

- a. Implementation of more advanced waste treatment techniques before waste is discharged to waterway.
- b. Diversion of effluents to streams with higher flow or at least a higher assimilative capacity.
- c. Storage of effluents during periods of low stream flows.
- d. Curtailment of use.

- e. Implementation of an acid mine drainage pollution program.
- f. Augmentation of low stream flows to increase assimilative capabilities.

Implementation of present treatment standards established for the sub-region will reduce the water quality problems in many areas, but more advanced water treatment techniques such as tertiary treatment and distillation presently are not the most practical or economical solution for the majority of the sub-region's problem areas.

Diversion of wastes or dilution of water only qualifies as a reasonable alternative in a few instances. The cost of developing the required surface water facilities in adjacent basins, plus the high cost of transmission makes this a more expensive solution. Even at high cost, major quantities of water, in excess of that already pre-empted for other uses, are not readily available in these nearby basins.

Storage of effluents during the periods of low stream flow would be the answer only in small isolated areas as the topography and density of development in most areas of the sub-region would preclude long time storage of large quantities of effluents.

Curtailment of use, other than prudent utilization of water without undue waste, does not fit into the expected development pattern in Appalachia and is not a realistic solution. The exception to this is the use of water for industrial cooling. Here a practical and economical alternative exists in the use of cooling ponds and towers. Therefore, cooling water needs are not a major requirement that must be met by river development. However, where water is made available for other purposes, and when its use as cooling water is compatible with other uses, and consistent with water quality standards, then it is less expensive than cooling ponds or towers and, therefore, an added benefit to development.

Implementation of an acid mine drainage pollution program would do much to reduce the water quality problems in many areas of the sub-region. Mine drainage pollution control programs should be carried to completion in areas where they have begun and mine drainage pollution control should be added as a project purpose measure in the planning of potential projects in the future which are located in areas where this type of pollution is a major problem.

It appears that the most practical solutions to the residual water quality problems in Sub-region F are the augmentation of low stream flows, and more importantly, implementation of an acid mine drainage pollution program where necessary and the development of advanced treatment facilities.

General Recreation

Water is a focal point for outdoor recreation, but outdoor recreation needs can be partially met without extensive water development by means of parks and wilderness areas (including small lakes) which can provide for a portion of the outdoor recreation, fishing and hunting needs of the sub-region. Therefore, recreation was not considered as the primary or single purpose for which major developments should be initiated; however, because of the great recreational need of Sub-region F (the greatest in all of Appalachia), and also because a year-round recreational facility in many cases provides new jobs and stimulates the economy of an area, the recreational potential of the projects which have been selected to satisfy other water resource needs should be developed to fullest potential and recreation treated as a co-equal purpose.

Power

Water resources development to meet fully the needs of flood control, water supply, water quality control and general outdoor recreation would include power operations in any selected reservoir site where it is economically feasible in order to partially satisfy the greatly increasing power demand for Sub-region F. Development of hydroelectric power as an addition to the other project purposes was reviewed and is possible at several of the potential dam sites in the sub-region. The inclusion of power facilities as a part of potential reservoir projects can never begin to fulfill the growing power demand but they will be added as a project feature whenever they are found economically feasible and potentially valuable in helping to fulfill the growing power need.

The water resources plan for Sub-region F must basically contain all of the following:

- a. Reservoir storage for flood control.
- b. Local flood control measures where economically feasible.
- c. Prosecution of programs for controlling and regulating the use and development of flood plains where other means of flood control are not economically feasible.
- d. Maximum practicable degree of waste treatment.
- e. Reservoir storage for regulation of dependable flows for water supply and water quality control.
- f. Implementation of an acid mine drainage pollution control program.

- g. Continuation and expansion of current land management and conservation programs.
- h. Maximum economical development of the recreation potential of project lands and waters through provision of specific facilities for recreation and multiple use of facilities required for other purposes.
- i. Maximum practicable degree of hydropower development.

A preliminary selection of potential projects which would offer the best possible solution to the needs of the sub-region was required in order to provide basic data for establishment and evaluation of the water resources development study contained herein. Major sites were selected in this preliminary phase from map studies. This selection was based primarily on topography, but consideration was also given to selection of those sites having an apparent storage potential and an acceptable dam site. Subsequently, field visits to each site were made by representatives of the Corps of Engineers. This reconnaissance provided information on possible engineering and geological problems which could be encountered, cultural development in the reservoir areas, and general attributes of the sites. Storage capabilities were developed in engineering studies, along with the relationships between storage capacity and structure size, and preliminary cost information. Cooperating Federal, state and local agencies provided preliminary evaluations of sub-basin needs and potential alternatives. Where such requisite information was not sufficiently detailed or disaggregated from gross water area or sub-regional estimates of needs to permit adequate growth center analyses, the Corps of Engineers made necessary additional studies to accomplish this. Framework evaluations are contained in other Parts and Appendices of this report. Those sites having obvious defects such as unsuitable geologic conditions, excessive costs or relocations, apparent conflicts, and extremely poor cost to storage relationships were eliminated from further consideration. In this manner, sites were analyzed and compared. In the Pittsburgh Engineer District, a total of fifty potential multiple-purpose reservoirs were considered. Of these 50 sites, a basic plan of 37 multiple-purpose projects of which 5 are presently authorized were retained in the preliminary stage of analysis.

Data on the 37 potential sites which were retained were developed in greater detail. Preliminary designs and cost estimates were made for at least two and in most cases three sizes of development. Low flow augmentation storage-yield relationships, flood reduction-storage relationships, preliminary evaluation of potential uses of the water resource goods and services provided, and preliminary analysis of non-monetary beneficial and detrimental effects of each site were developed. Based on these preliminary gross appraisals of needs, those projects having the greatest potential for ultimate development were selected.

Local flood protection and flood prevention measures were investigated to supplement the reservoir system for flood control and flood prevention against flood damages. Protection and prevention measures

such as channel deepening and widening, the construction of walls and levees, raising of bridges, and provision of drainage systems and pumping stations were considered. Of the 58 local protection projects evaluated, 30 potential local projects along with 8 which were previously authorized were retained in the preliminary stage of analysis.

The projects which have been retained in the Framework Study developed by the Corps of Engineers based on the investigations described above are shown in Table 12-28 and Figure 12-50. These projects, in conjunction with the water resources plan recommendations of the Department of Agriculture (Soil Conservation Service), and the States of Pennsylvania, New York, West Virginia, Ohio, and Maryland, with study areas in Sub-region F have been combined to provide the alternatives for formulation of the overall water resources plan for the sub-region.

11. BASIN AND GROWTH AREA DISCUSSIONS OF ALTERNATIVES

The structural and non-structural alternatives given below were selected from water resource development opportunities suggested for consideration by various participating agencies. They embrace alternate measures relevant to the growth centers, following the same river basin - economic area subdivisions discussed previously (see Figure 12-3). They assume future availability and developability unless restricted by other prohibitive environmental and developmental constraints.

The needs, opportunities and alternatives are discussed below, from headwater areas to downstream areas by river basins and basin subdivisions. (See Figure 12-11 through 12-48 for features in each sub-division.)

Allegheny River Basin

Subdivision A-1

Franklin, Pennsylvania to headwaters.

Growth Centers: Primary: Jamestown, New York - Warren, Pennsylvania and Olean, New York - Bradford, Pennsylvania.
Secondary: Coudersport, Pennsylvania; Franklinville, New York and Oil City - Franklin, Pennsylvania.

Jamestown-Warren. Flood damages in this growth center amount to about \$700,000 annually in the Lake Chautauqua - Chadakoin River, Cassadaga Creek, and lower Conewango Creek drainage areas, from Mayville to Falconer, New York, Gerry to Levant, New York, and Waterboro, New York to Warren, Pennsylvania. The damage results from winter and

summer flash floods which rapidly concentrate flood runoff into Lake Chautauqua from steep, direct draining streams, and slowly concentrate flow from the remainder of its flat profiled, wide flood plain and consequently marshy, sluggish main streams. Flood damages to industrial and recreational developments, along the lake perimeter and the Chadakoin River have been estimated to be about \$470,000 annually. Low lake levels, due to evaporation and lake-level regulation, aggravated by untreated sewage pollution of the lake, cause significant recreational losses. Damages to agriculture in the balance of the area are about \$230,000 annually. Flooding in the Allegheny River sector is adequately controlled by the Allegheny Reservoir. Development of 600 acres of flood-free plain along the above streams will be needed for urban land use by 2020 around widely scattered industrial sites in the growth center. About 158 mgd additional water supply for municipal and industrial purposes will be required throughout the growth center. About 185 cfs additional flow for water quality improvement purposes will be needed by 2020 in lower Cassadaga and Conewango Creek reaches.

In the Chadakoin River, either a diversion - storage flood protection project in Lake Chautauqua and the Chadakoin River above Warner Dam (including its reconstruction) or an alternative upstream watershed project in the lake area, or a local flood protection project at Jamestown - Falconer, New York, will be needed. The plan for the authorized diversion storage project (without local or state action) will probably be abandoned by 1970, leaving the Lake Chautauqua - Chadakoin River with flooding and conservation needs by 1980. The diversion project would completely eliminate current and future flood damages in that area. The USDA Upper Conewango Creek Watershed Project is under construction, and if operative by 1980, would reduce current flood damages in the Conewango Creek Valley above Kennedy, New York by about 90 percent. This project is intended to improve the currently poor agricultural potential in the watershed. Supplementary protection will be needed at other locations on streams tributary to Conewango Creek above Waterboro, New York. Agricultural recovery may not occur, or may not be the most important future alternative use. Consequently, in the future, it may be possible to use part of the main upper Conewango Creek and resources for surface storage needs. Other projects to meet needs associated with growth in the immediate hinterlands of Warren border on Brokenstraw Creek (to provide flood protection and water supply) will be required for development of about 9,200 acres of land industrially. Water-based recreation, amounting to 11 million visitor days, and fishing and hunting needs can be met to some degree from other water resource potentials such as surface storage developments in Cassadaga and Stillwater Creeks. Power needs will require consideration of favorable pumped-storage hydroelectric power peaking possibilities associated with the Lake Chautauqua - Lake Erie head differential. A pumped-storage reservoir located on Big Run, hydropower facilities in Chautauqua Creek, and flow protection measures along Chautauqua Creek through Westfield will be required.

Olean-Bradford. (Franklinville, Coudersport) Industrial growth in this primary-secondary growth center is affected by minimal urban flood damage along the Allegheny River. Growth extending from Allegheny Reservoir through Olean to Coudersport and along Tunungwant Creek from its mouth to above Bradford is due mainly to flood damage reduction by existing projects at Salamanca and Olean-Portville, Coudersport, Eldred and Bradford, Pa. Extensions of these projects, or other alternatives will be required by 2020 to protect future urban land use. Ponding areas in Olean contain needed developable lands. Analysis will be required to permit future use of a portion of these acres without seriously impairing pondage requirements for the project. An authorized, currently inactive, local project at Allegany, N. Y., below Olean, may be required by 1980 to protect developments along Five Mile Run. Urban land use needs throughout the growth center area will approximate 11,440 acres by 2020. Annual upstream rural damages currently approximate \$125,000. Water supply of 66 mgd will also be required by 2020, particularly at Bradford; and water quality needs are estimated at 55 cfs. To partially meet these and other miscellaneous needs, there are five potential USDA upstream watershed projects for Oswago, Potato, Great Valley and Little Valley Creeks and the Upper Allegheny River.

Oil City-Franklin. About 2,000 acres of flood plain lands (including urban land use) will be needed by 2020. The USDA Oil Creek Upstream Watershed Project will be in operation by 1980 to satisfy flood protection needs for current development. If this secondary growth center sufficiently expands beyond expectations to become a primary growth, expanded water resource development for water supply, water quality and additional flood protection needs will be required. This secondary growth center is contiguous with the Meadville Primary Growth Center in the French Creek Valley. Relatively small amounts of annual flood damages occur in Franklin along lower French Creek at its mouth. Current annual flood damages along the Allegheny River in Franklin are approximately \$600. Some relief will be furnished by potential upstream reservoirs. It is estimated that water-based recreation and fish and wildlife development, to handle 3.5 million visitor-days, will require additional facilities and scenic developments in the Allegheny National Forest and along and in the Allegheny River between this growth center, the upstream Jamestown-Warren growth center (up to and including Allegheny Reservoir), and the downstream Clarion growth center. Recreational possibilities planned by Venango County, the Commonwealth of Pennsylvania and Western Pennsylvania Conservancy (private-state) will be partially developed by 1980 in this area.

Subdivision A-2

Entire French Creek Basin

Growth Centers: Primary: Meadville, Pa. (part of New Castle - Sharon - Meadville).

Meadville. Lack of additional water resources development would seriously constrain growth in the Meadville area, part of the primary growth center associated with New Castle and Sharon in the Beaver River Basin. Water related problems, limiting growth, are projected along a potential growth axis northwest from the Metropolitan Pittsburgh area to the Metropolitan Youngstown-Warren, Ohio, area. Meadville, in the French Creek Basin, is centrally located between the Erie-Lake Erie-Lake Chautauqua areas on the north and the Allegheny River area terminating at Oil City - Franklin on the south. Upstream reservoirs at Muddy Creek, Woodcock and Union City are expected to be completed and in operation by 1980. The reservoirs will lower major flood heights by about 3-4 feet and reduce current annual flood damages at Meadville to about \$300,000. Flooding, potentially in excess of recorded flood levels, will be a serious constraint to growth. Land for industrial sites is generally in the flood plains of French and Cussewago Creeks. Of a total estimated land need of about 2,000 acres by 2020 there are about 200 acres of prime industrial land located in the flood plain within the municipal confines of Meadville. The growth center has potential to develop on these lands and then to extend development upstream along the French and Cussewago Creeks flood plain. There will be need to further reduce the flood hazard by local protection measures involving additional flood storage, or by channel improvements. Flood hazard reduction is needed for expansion of existing industry, the chemical industry, and to enhance the growth potential of contiguous vacant developable land.

Potential USDA upstream watershed projects in the LeBoeuf Creek Watershed in Erie County (within 20 mile radius of Erie, Pa.), at the Upper French Creek Watershed in Erie and Chautauqua Counties, and at the Sugar Creek Watershed in the French Creek Basin south of Meadville, if implemented by 1980 would not sufficiently decrease flood protection needed at Meadville, but would supplement existing flood protection for urban and agricultural areas at Wattsburg, Waterford and Sugar Creek, and for recreational purposes of the entire growth center. About 87 mgd for municipal and industrial water supply will be required for augmentation of surface and ground water sources, existing and potential. Water quality should not impede growth in the area. Existing water oriented recreation and fishing and hunting opportunities for the growth center and the French Creek area are currently provided by developments and facilities located in and surrounding the growth center area. Facilities capable of providing an additional 10 million visitor-day water oriented recreation capability will be needed by 2020. Redevelopment of existing facilities such as the privately owned Cambridge Springs recreation area will be needed to extend growth center recreational potential in the 10-mile reach above Meadville. Interstate Route 79 provides direct access to the growth center from the north and the south, and U.S. Routes 6 and 322 form links to this route, influencing expansion to the east and west from the growth center. Indicated urban growth, by 2020, will probably embrace Saegertown and Union City, and extend westward to include the Conneaut Lake area. Downstream urban land use in the flood plain below Meadville approaching the Franklin secondary growth center is currently uncertain, but probable. Woodcock Reservoir has a moderate reservation for low-flow augmentation to provide a minimum of 75 cfs summer flow in French Creek at Meadville to adequately supply water quality needs by 2020.

Subdivision A-3

Middle Allegheny River, downstream from Franklin to below Ford City.

Growth Centers: Primary: Ridgway - St. Marys; DuBois - Clearfield; Kittanning - Ford City.
Secondary: Clarion, Emporium, Punxsutawney.

Ridgway - St. Marys (Clarion - Emporium). The water related problems of the Ridgway - St. Marys growth center area (including Johnsonburg and extending to secondary growth centers at Clarion and Emporium) that will affect industrial growth are: flood damage, water quality improvement and water supply. The primary growth center (the triangular nucleus) will need flood protection on an estimated 50 acres for future urban land use in the flood plain. General area industrial and recreational opportunities growth will require an estimated 2,500 acres. Reclamation and redevelopment of strip-mined lands adjacent to the Clarion River are needed. St. Marys, located high in the drainage basin, needs 44 mgd for domestic and industrial water supply and 25 cfs for waste assimilation. It is expected that water quality improvements will be made before 1980 in the area tributary to the existing East Branch Clarion Reservoir, upstream of Johnsonburg. However, current allocations of storage at existing East Branch Reservoir to flood control and low-water needs for Johnsonburg preclude furnishing water supply to St. Marys, indicating need for surface storage and distribution facilities on the West Branch Clarion River. **This stream currently contains water of exceptional quality, and will require development of either small upstream watershed reservoirs, or one large main stream impoundment above Wilcox.** Low-flow augmentation and benthic biologic needs for fish and wildlife and recreation, related to a scenic corridor development below Ridgway, will be required by 2020. Growth potential, based on environmental enhancement, will unite activities of the presently isolated upper growth center triad nucleus of Johnsonburg-Ridgway-St. Marys, with those of the downstream Clarion River Basin and adjacent area communities. By 2020, recreation need of about 5.5 million visitor-days will require that the Clarion River area be developed as a recreational and scenic corridor. This would also become part of the Allegheny Interstate (terminal) complex */ possibly involving the Allegheny National Forest, the stateowned Kittanning State Forest, Cook Forest, Clear Creek, Bendigo and Elk State Parks; large areas of State Game Lands; large water-oriented private land holdings, and the Clarion River from Ridgway-St. Marys to the Allegheny River. An ideal recreational and scenic corridor terminus or gateway to these areas would be the potential St. Petersburg impoundment to most effectively utilize the potential of existing water-oriented State and Federal recreation and conservation opportunities for the growth center's recreation needs. There will be need for comprehensive planning by 1980 to mitigate water related problems of flood control,

*/ Appalachian Regional Commission Report on Highlands Recreation Area Potential.

water quality and recreation at this compounded growth center (and downstream growth centers), particularly the nearby Greater Pittsburgh Metropolitan growth center. The latter, with the contiguous Kittanning - Ford City primary growth center in the Allegheny River reach below the mouth of the Clarion River, requires at least an additional 3 feet of flood reduction, and at least 2.5-3 feet reduction for other primary growth centers downstream from Pittsburgh. Flood reduction of this magnitude would be needed to free industrial land for future urban use in the relatively narrow flood plains of the main stem Allegheny and Ohio Rivers. Water related problems will affect future growth in the Ridgway-St. Marys growth center. Access, by existing Interstate Highway Routes 79 and 80, the Allegheny Valley Expressway, and a potential Lakes-to-Sea Highway, is expected to promote growth in the area in the vicinity of Clarion. A suggested new town site lies in the area between Clarion and the DuBois-Clearfield primary growth center. A potential exists at Clarion State College for expansion into a major university with a large expansion of its integral research and development complex and research-learning center. Water oriented conservation, education, and all manner of educational research and experimentation*/ at this center, leading to advanced degrees and a possibility of an international clearing house for this type of knowledge, would be encompassed within this undertaking by 2020, or before. Extensive public and private expenditures for recreational and tourist facilities in the area, and potential industrial, commercial, and residential developmental possibilities compatible with resource and other advantages of the area have high likelihood of fulfillment. Competition from other, apparently more economic, locations within the tri-state area with slightly more adequate raw materials, labor, markets, and transportation, may overshadow the Clarion growth center for plant location of basic industries such as steel making, aluminum reduction, machinery and heavy fabrication. However, the external economies of recreation, education facilities, community amenities, and environmental advantages in this growth center may more than balance deficiencies. Growth potential exists for chemical industry developments**/ with spinoff satellite industrial developments. Other possible development appears in fabrication and assembly operations for manufacture of television tubes, trailers, and communications equipment, etc.***/ It is estimated that some 100,000 acres of land will be needed for such extensive opportunities as above, of which about 60,000 acres will be needed for recreation and tourist facilities. About 5,600 acres will need reclamation and rehabilitation. Water quality improvements including mine drainage abatement will also be needed to achieve extensive development potential in the growth center.

*/ Including the Flexible, All-year School, and other educational innovations.

**/ EDA Feasibility Study.

***/ Private utility assessment.

Peaking demands for electrical power for the area and sub-region will require consideration of pumped-storage development at the potential St. Petersburg reservoir site, possibly in combination with conventional power generation. In the eastern extremity of the Ridgway-St. Marys growth center at the Emporium secondary growth center water supply requirements by 2020 will approximate 3 mgd, or more, from Sinnemahoning Creek developments. A potential upstream watershed project or ground water development will be needed to augment existing supply. Ground water sources may be polluted with brine.

DuBois-Clearfield. This primary growth center straddles a ridge between the Clarion River drainage area to the west and the West Branch Susquehanna River drainage area to the east. These growth centers are connected by Interstate Route 80. Growth possibilities will probably extend this area west to Bookville and include Brockway and Curwensville. Water problems affecting industrial growth are lack of recreation, water supply and water quality. Current residual annual flood damages amount to \$5,000 at DuBois. Future needs for urban land in the flood plains approximate 50 acres at DuBois-Clearfield. Growth will require use of additional flood plain lands, with extension of existing local flood protection projects. Estimated area urban land use requirements will exceed 6,000 acres. About 90 mgd for municipal and industrial water supply and increased flow for water quality improvement will be needed by 2020 to serve current and potential industry. Alternatives in the area include an upstream watershed project on Sandy Lick Creek and reservoirs on North Fork and Little Sandy Creeks. Existing and potential highway access from all directions will serve development of recreational facilities. Water-related recreation growth center needs will approximate 6 million visitor-days by 2020. Potential satisfaction of this need, and needs outside the growth center, will require development of additional recreation opportunities by the Commonwealth of Pennsylvania (such as the Otocsin Pennsylvania Recreation Area) to supplement existing and potential Federal developments.

Punxsutawney. There are no significant water related problems at the secondary growth center at Punxsutawney. Recreation needs of about 1.2 million visitation-days by 2020 and small current flood damages to unprotected areas will require consideration of upstream watershed alternatives. Future industrial development will probably require seasonal low flow augmentation for water supply, and will present distribution problems.

Kittanning-Ford City. The most serious water related problem impairing the growth center is flooding along the Allegheny River. Current annual flood damages amount to about 60,000 dollars. Future urban land use needs are estimated at about 1,000 acres in the long, narrow flood plain extending upstream and downstream from the growth center nucleus currently lacking sufficient developable land. By 2020, an estimated 6,300 acres will be required for urban use. Consequently, hinterland development will be required in the Allegheny River reach from Freeport upstream to Reesedale, and off-river from Worthington on the east

to Rural Valley on the west, and at other points. Rural Valley, on Cowan-shannock Creek will need flood protection for future urban land use. Reesdale, Templeton, Murphys Flats, Tamtown and Clinton's future industrial development sites, in and adjacent to the flood plain along the Allegheny River, will need flood protection by 2020. The most favorable alternative is the potential upstream St. Petersburg Project. Recreation needs for this area will approximate 9.0 million visitor-days by 2020. Expanded recreational areas and facilities, scenic development of the Allegheny River, water quality improvements at existing reservoirs, and potential reservoir developments in this and contiguous areas will be required. Water supply is not a growth center water problem for an ample source exists in the Allegheny River.

Subdivision A-4

Entire Kiskiminetas River

Growth Centers: Primary: Indiana, part of Greater Pittsburgh and Johnstown-Altoona (see Sub-region B).

Indiana. Water related problems at the Indiana primary growth center include water supply (and distribution), water quality and recreation. By 2020, about 65 mgd for municipal and industrial water supply and 72 cfs for low flow augmentation will be needed. Other smaller watershed developments will be required to supplement the Two Lick Creek and Yellow Creek Reservoirs. Augmentation by ground water development will not meet the water supply deficiency. There are no current flood damage problems to urban land, or urban land use needs in the flood plains. Recreation needs, by 2020, are estimated at about 6.0 million visitor-days. State developed water oriented recreation at Yellow Creek State Park Reservoir and at Naturealm Recreation Area will partially supply this demand. Upstream watershed developments with expansion of recreational areas and facilities at existing Federal reservoirs are indicated as a future recreation need for this growth center.

Johnstown. Johnstown, part of the Johnstown-Altoona Regional (primary) growth center, is oriented economically eastward with Altoona as part of Sub-region B, and hydrologically westward as part of the drainage system of Sub-region F. Water related problems for Johnstown include flooding and lack of water supply. Unprotected urban areas currently experience flood damages of \$30,000 annually. About 300 acres of flood plain lands for urban use by 2020 will need protection. A total urban land use requirement by 2020 approximates 1,400 additional acres. About 150 mgd for municipal and industrial water supply will be needed by 2020, for which upstream watershed storage developments will be required. Recreational demand will amount to about 31.0 million visitation-days by 2020. Developments and expansion in contiguous stream basins will be required to supplement existing Federal and State water oriented recreation developments.

Greater Pittsburgh (Allegheny). The water related problems causing some impairment to industrial growth are flooding and poor water quality. Annual headwater area urban flood damages at Ligonier from upper Loyalhanna Creek amount to about 37,000 dollars. Non-agricultural water supply needs are currently minor. Latrobe will need additional water to augment Latrobe Reservoir supply by 2020, if industrial growth is concentrated at urban land use sites in the urban and hinterland areas of Latrobe and Ligonier. Water oriented recreational demand of the entire growth center, and for the Ligonier-Latrobe area in particular, will require upstream watershed developments and expansion of recreational possibilities at existing Loyalhanna and Conemaugh Reservoirs. A PL-566 reservoir project on Four Mile Run may be implemented by 1980 for water supply, flood protection at Ligonier, and for general area water oriented recreation. Water quality improvement needs of about 30 cfs for Latrobe are required from this site, with maximum development of recreation opportunity.

Subdivision A-5

Allegheny River Basin, from mouth of Kiskiminetas River to mouth of Monongahela River.

Growth Centers: Allegheny Basin, part of Pittsburgh Regional Growth Center.

Greater Pittsburgh. The water related problems in this part of the growth center include annual flooding, producing damages of about 120,000 dollars. Water supply and water quality improvement needs by 2020 are not critical. Anticipated needs for flood plain lands for urban use approximate 148,000 acres by 2020. To help meet regional recreation demand, the potential St. Petersburg Reservoir is needed and extensive potential recreational expansion and development of scenic and recreational opportunities are needed as well as opportunities on the Allegheny River itself. Flood plain management will also be required.

Monongahela River Basin

Subdivision M-1

Entire Tygart River Basin.*/

Growth Centers: Primary: Elkins-Buckhannon-Philippi, W. Va.
Secondary: Grafton, W. Va.

Elkins-Buckhannon-Philippi. Water related problems of this growth area, mainly located in Sub-region G, exist at the primary growth center nuclei at Buckhannon-Philippi and Belington-Elkins. Current residual urban flood damages amount to about \$12,000 within the protected area of local flood protection projects at Buckhannon and Elkins. Damages currently occur to the flood plains outside the protected area, where future urban land use needs are approximately 200 acres. Water supply needs by 2020 are estimated at 44 mgd for growth center municipal and industrial use. Water quality improvement needs will be about 30 cfs at Philippi and 15 cfs each at Buckhannon and Elkins. Growth potentials in the Belinton area and in the area above Elins, particularly the latter, are of such attractive growth potential to merit detailed future study for future flood protection and water supply. No other area in the sub-region compares with the resource and potential developmental advantages of about 13,000 acres of easily protected, developable flood plain available above Elkins. The plain is wide and flat, about 20 miles long, about a mile wide, and would probably support a new town complex with an extensive array of light industries. Water oriented recreation needs for the growth center are estimated to be about 2.0 million visitor-days by 2020. Appalachian Corridor H will probably increase this demand by connection to Interstate Route 79 on the west and large population areas on the east coast. Potential large reservoirs on the Buckhannon, Middle Fork and Upper Tygart Rivers will be required to satisfy the growth center and sub-regional recreation demands. Superbly attractive settings, especially in the Audra State Park area of the Middle Fork River, and in the upper Tygart River, in relation to the Cranberry Unit and Cranberry Back Country of the Monongahela National Forest, Kumbrow State Forest, and Holly River State Park will be needed for water related recreation and water supply development for 1980-2020 growth. A potential upstream watershed project for the upper Buckhannon River will also be needed to reduce current residual flood damages and minimize damages (due to potential higher floods exceeding the present design flood) at Buckhannon, to furnish water supply and recreation enhancing industrial expansion possibilities in the partially protected and unprotected areas of the city.

*/ Partly in Sub-region G.

Grafton. Needs for the Grafton secondary growth center are relatively insignificant. Potential reservoirs on Laurel and Teter Creeks will be needed to supplement existing Tygart Lake for Grafton and downstream needs in the Monongahela River Basin if development occurs.

Subdivision M-2

Entire West Fork River Basin, headwaters to just above Fairmont, W. Va.

Growth Centers: Primary: Clarksburg-Fairmont (and Morgantown), W. Va.

Clarksburg-Fairmont. The water related problems of this growth center, the three-city node of Clarksburg-Fairmont-Morgantown, are flood damages, insufficient water supply and scarcity of developable land in the flood plains. Clarksburg is the most important trading center in the growth center. The authorized Stonewall Jackson Reservoir is expected to be in operation by 1980. Annual residual flood damage in the Clarksburg area from Weston to above Fairmont will approximate 193,000 dollars. About two-thirds of this residual damage will occur at Clarksburg. The flood problem in the West Fork River results from local tributaries, including the larger tributaries of Elk Creek and Limestone Run (at Clarksburg), Hackers Creek, Tenmile Creek and Simpson Creek. Protection of the West Fork River main stem areas of Clarksburg, Shinnstone, Worthington and Monongah, and the area of Bridgeport on Simpson Creek will require flood protection to free flood plain lands for future urban use. About 8,300 acres of urban industrial land will be needed by 2020. Future urban land in the Clarksburg area is restricted by the limited developable topography in the flood plain. Major highway relocations out of the flood plain would be a necessary future consideration for land utilization and local flood protection. These needs will require reservoir projects on the larger West Fork River tributaries. Water supply needs for Clarksburg municipal and industrial purposes by 2020 are estimated at 30 mgd to supplement the Clarksburg Water Company supply. Water quality improvement needs are estimated to be 45 cfs by 2020. Diversion of water from the Buckhannon River to the West Fork River Basin may be required to induce and sustain projected growth, particularly diversification of industry. West Fork River water resource developments will not solve the water problems of the remainder of the growth center to the Fairmont area and further downstream to Morgantown. These are treated in the discussion of alternatives in the upper part of Monongahela River Subdivision M-5. Hydroelectric power opportunities for the growth center could be attached to head differentials and water transfers from and between the upper Buckhannon and the West Fork River Basins. Water related recreation opportunities are extremely limited to supply a growth center recreation demand of approximately 15.0 million visitor-days by 2020. Reservoir alternatives will be needed in contiguous areas to the east (via Appalachian Corridor H). Recreation development at Buckhannon, Middle Fork and Upper Tygart River Reservoirs will be needed for this growth center. Serious acid mine drainage problems in the West Fork River Basin will require abatement. Some tributary streams are grossly polluted.

Weston-Glenville. The secondary growth center at Weston appears to have relatively few water related constraints to growth once the Stonewall Jackson Reservoir and Polk Creek upstream watershed projects are in operation. Flooding is controlled and there is no apparent water supply deficiency. About 0.5 million visitor-days of water oriented recreation will be demanded by 2020 in the growth center area extending across the Little Kanawha River divide to Glenville.

Subdivision M-3

Cheat River Basin, Headwaters to Rowlesburg Dam.

Growth Centers: Contiguous sub-regional growth centers in Sub-regions F, B and G.

Parsons-Hendricks-Hamilton, W. Va. at the head of Rowlesburg Reservoir exhibits future growth potential. Water supply and recreation opportunities attached to the Rowlesburg project will satisfy local industrial and recreational needs. Expected to be in operation by 1980, this project will offer an excellent opportunity to meet future needs by expanded facilities with the Monongahela National Forest, for a broad water development complex of water related recreational facilities for visitation by 1980-2020.

Sub-division M-4

Entire Youghiogheny River Basin, headwaters to mouth at the Monongahela River.

Growth Centers: Primary: Uniontown-Connellsville, Pa.;
Somerset, Pa. Monongahela Basin portion of
Pittsburgh.
Secondary: Oakland, Md.

Uniontown-Connellsville. This primary growth center straddles the divide between Uniontown in the Monongahela River drainage and Connellsville in the Youghiogheny River drainage. The Uniontown area is described in the discussion of alternatives in Subdivision M-5. While extensive growth is projected for the Connellsville area itself, growth potential extends upstream along the Youghiogheny River to Confluence, and from Confluence upstream along the Casselman River to Grantsville, Md., including Rockwood, Garrett and Myersdale, Pa., mainly in off-river areas. Growth in the area below Connellsville will occur in Greensburg, Mt. Pleasant and Youngwood in the Greater Pittsburgh Regional Growth Center. The existing Youghiogheny River Reservoir located above Confluence on the upper Youghiogheny River does not furnish needed flood protection to Connellsville. Annual flood damages of about \$450,000 occur due to uncontrolled areas above Confluence receiving the flows from Casselman River, Laurel Hill Creek and other tributaries. Meyersdale, Garrett, Rockwood, Confluence and Connellsville have flood

damages and are developmental centers. Local protection projects at Confluence and Rockwood are expected to be completed by 1980; however, these provide only partial protection. Two additions to reservoir protection will be needed on Laurel Hill Creek and Upper Casselman River. A reservoir near Oakland on the Upper Youghiogheny River will also be needed to reinforce the flood control and low flow capability of the existing Youghiogheny Reservoir to protect this primary growth center and the Greater Pittsburgh Center. In addition to protection by reservoir storage, local flood protection projects of limited scope, involving levees and channel improvements, will be needed for this growth center to remove impediments to growth. About 500 acres of flood plain lands will be needed for urban development by 2020. Additional water supply required by 2020 is estimated at 5 mgd. Water quality improvement is needed because of upper Casselman River pollution. A USDA Upper Casselman River upstream watershed project will be required with the larger Upper Casselman River Reservoir for these needs. Additional facilities at Youghiogheny Reservoir, Deep Creek Lake and the Ohiopyle Pennsylvania Recreation Area and at new reservoirs capable of providing an additional 10.0 million visitor-days will be required between 1980 and 2020. Scenic and recreational river opportunities will require investigation and development in the Youghiogheny Reservoir - Oakland reach of the upper Youghiogheny River and in the Youghiogheny Dam - Connellsville reach along the main stem of the Youghiogheny River. Hydroelectric power potentials to supply the projected power demands will require analysis at a number of potential reservoir locations possessing favorable head differentials.

Somerset. The water related problems for the Somerset primary growth center include inadequate water supply and water quality. Flood damage from Coxes Creek at this growth center is not significant. By 2020, an additional 75 cfs will be needed for municipal and industrial water supply; and 13 cfs for water quality. Reservoirs on Laurel Hill Creek and the Upper Casselman River will be required to meet these needs, and for water based recreation demand of about 5.0 million visitor-days. Agricultural water supply and water related needs require detailed additional study.

Oakland. This secondary growth center will need additional water supply by 2020 amounting to about 1 mgd for municipal and industrial purposes. Agricultural water supply needs are not significant. The Little Youghiogheny River upstream watershed project is expected to be completed by 1980, will partially furnish the water supply needed, protect the agricultural flood plain, serve land use improvements, and provide some water based recreation. Water based recreation needs by 2020 will approximate 7.0 million visitor-days. Additional study is necessary to establish agricultural needs for this area.

Greater Pittsburgh (Monongahela). Broad-based water related problems in the lower Monongahela River Basin are: flooding; lack of water supply; poor water quality; scarce developable urban flood plain land; and environmental degradation. There is a need to relate these

problems comprehensively to the entire Monongahela River Basin. A preliminary integrated correlation is presented below in Subdivision M-5 of structural alternatives to meet growth center needs in the Washington, Allegheny, and Westmoreland County portions which drain to the Monongahela River.

Subdivision M-5

Entire Monongahela River and Cheat River from mouth to Rowlesburg Dam.

Growth Centers: Primary: Fairmont-Morgantown (and Clarksburg), Uniontown (and Connellsville), Monongahela portion of Greater Pittsburgh.
Secondary: Waynesburg.

Fairmont-Morgantown (and Clarksburg). A water related problem for part of this West Virginia tri-nodal growth center is some flooding along the Monongahela River flood plain and upstream along Deckers Creek. Protection for Monongahela River areas down to and including the Greater Pittsburgh Growth Center will require supplementation of Tygart River and Rowlesburg Reservoirs by Teter Creek and Laurel Creek Reservoirs just above Tygart, and Buckhannon, Middle Fork and Upper Tygart Reservoirs in the Upper (M-1) area; and possibly upstream watershed projects on Sandy Creek and Three Fork Creek just upstream (in M-1). Current average annual damage amounting to about \$40,000 occurs in lower Deckers Creek, and about \$36,000 in the upstream reach. The growth center will need in excess of 45 cfs for water quality improvements if strip-mine reclamation and water quality programs are in effect by 1980-2020. Of a total urban land use need of about 8,300 acres, about 500 acres of protected area will be required on the flood plains by 2020. Water related recreation needs for the tri-nodal growth center area will approximate 15.0 million visitor-days. In this portion of the growth center, potential upstream watershed projects on Paw Paw Creek and Prickett Creek will be needed for recreational purposes. In addition to recreation furnished by existing Cheat Lake and Rowlesburg Reservoir (in operation by 1980), these will have to be supplemented by the recreation potentials of reservoir developments on Big Sandy Creek, Dunkard Creek and Ten Mile Creek. Also, acid mine drainage below Rowlesburg Dam to Cheat Lake will require abatement.

Waynesburg. The water resource needs for this growth center include about 5 mgd of water supply and protection of about 200 acres of flood plain along South Fork of Ten Mile Creek through Waynesburg, needed for urban development by 2020. Upstream watershed developments will be needed for water supply. Current annual flood damages are minimal, but flooding will constrain redevelopment in the flood plain. Pennsylvania owned state game lands in the vicinity will require supplementation by water based recreational developments on Ten Mile Creek above Waynesburg, on smaller tributaries and on the large branch of Ten Mile Creek north of Waynesburg to supply 2.5 million estimated visitor-days by 2020. A potential Dunkard Creek impoundment will also be required to provide needed water quality.

Uniontown (Connellsville). The water related problems for the Uniontown portion of the Uniontown-Connellsville primary growth center include flooding along Redstone Creek. Elimination of current average annual flood damages, estimated at about \$112,000, will require up-dating the authorized local flood protection project at Uniontown by 1980-2020. Water for municipal and industrial supplies are adequate, but distribution and treatment are needed. Water quality improvements on Redstone Creek will require 20 cfs by 2020. Water supply for urban improvement in the Uniontown-Connellsville primary growth center area will probably require diversion from Laurel Hill Creek and upstream Indian Creek reservoirs, from impoundments on Dunkard Creek to the west, or from Big Sandy Creek south of Uniontown. The latter impoundment will probably be more necessary since water quality improvement requirements at Connellsville will greatly exceed those at Uniontown, and extensive water quality improvements are needed for Dunkard Creek itself.

Greater Pittsburgh (Monongahela) Flood damage, currently approximating \$500,000 annually, occurs along the middle and lower Monongahela River and near the mouth of the Youghiogheny River in this growth center. This is primarily the result of uncontrolled flows from the larger upstream Monongahela River tributaries including Big Sandy Creek (Cheat River), Dunkard Creek, and Ten Mile Creek, and from relatively large upstream Youghiogheny River tributaries including Laurel Hill Creek, Upper Casselman River, Sewickley, Indian and Jacobs Creeks. About 2,000 acres of flood plain lands - 1,000 acres or more along the Monongahela River - are needed for urban use (1980-2020). Without flood protection of vacant land areas and other lands, redevelopment and growth possibilities will be impaired at Monongahela City, Donora, Monessen, Charleroi, Allenport, California, and McKeesport. Flood plain lands, requiring protection for future urban use, are located on the Monongahela River at the mouth of Pigeon Creek. These lands are flooded from creek overflow, river backwater and a number of other tributary streams. There are locations in the lower Youghiogheny River Basin, along its major direct tributaries including Sewickley Creek, Jacobs Creek, Indian Creek, and Upper Turtle Creek in their flatter headwater areas, which will require flood plain protection for future urban use. Heavily developed ridge land on the Youghiogheny River side of the divide, including Greensburg, Scottdale, Mt. Pleasant, Youngwood, and Melcroft, will probably require upstream watershed projects for flood plain protection, water supply, water quality improvements, and recreation. By 2020, water quality improvement will be needed for these isolated tributary locations in the growth center and will approximate, for example, 67 cfs in Sewickley Creek at Greensburg, 14 cfs in Jacobs Creek at Scottdale, and 11 cfs in Shupe Run (tributary to Jacobs Creek) at Mt. Pleasant. This is an indication of needs for upstream watershed structural alternative treatments, or which require tunneling or pipeline water transfer from contiguous surface sources. Flood protection by the authorized Rowlesburg Lake, expected to be in operation by 1980, will reduce current annual flood damages to about 200,000 dollars. The proposed Big Sandy Creek, Dunkard Creek and Laurel Hill Creek Reservoirs would substantially reduce flooding along the Monongahela and Youghiogheny Rivers. Water supply for

growth center future urban use is available from the rivers, particularly if future water quality improvements are made. However, additional consideration about the latter is necessary because multiple-purpose reservoirs could provide water required for power plant cooling, industrial recirculation, and other water withdrawals unique to heavy industrial specialized processes. Therefore, further detailed study will be necessary to obtain flexibility, systemization of regulation, and adequate water management of all water resources. Estimated water quality needs for main river growth points would be satisfied by Monongahela River flow and future pollution control and abatement programs by 2020. Another alternative requiring detailed future study to establish economic and engineering feasibility is the potential tunnel conveyance of good quality headwater surface water to the growth center. Future studies will also be needed to establish the need for hydroelectric power possibilities attached to significant head differentials within and between contiguous basins. To meet power needs of this growth center, study of hydropower potential will be needed of the Upper Cheat, Upper Youghiogheny, Tygart, and Buckhannon - West Fork Rivers compared to peak demand for electrical energy. Recreation demand for 1980-2020 of 251.0 million visitor-days for the five-county Greater Pittsburgh Region population will require development of water related facilities at impoundments, scenic river reaches in the Monongahela River Basin and other proximate areas in the contiguous Allegheny, Beaver, and Upper Ohio River Basins. A more detailed analysis of this demand and alternative measures to satisfy it will be needed as well. However, some of this need can be met by the facilities and possible expansions at existing Tygart, Youghiogheny, Deep Creek, Rowlesburg (by 1980), impoundment projects; potential impoundments on Big Sandy Creek, Laurel Hill Creek, Upper Casselman River, Upper Youghiogheny River, Dunkard Creek, Ten Mile Creek, Teter and Laurel Creeks supplementing Tygart Lake; potential Upstream Watershed Projects on Jacobs Creek, Turtle Creek, Sewickley Creek and Indian Creek; and existing (Ohiopyle) and proposed water oriented Pennsylvania, Maryland, and West Virginia State Recreation Areas; existing and potential riverside water recreation developments; potential scenic river developments on the Youghiogheny River and existing and potential water related Monongahela National Forest developments. Other water related developments that could meet the Greater Pittsburgh growth center needs are existing and potential projects in the contiguous Allegheny, Beaver, and Upper Ohio River Basins. These projects are discussed in the Upper Ohio River Basin Subdivision 0-1 presentation of growth center needs. Especially important is the display of alternative capabilities of the potential St. Petersburg Reservoir and/or scenic river which may be compatible or conflict with */ recreation and hydroelectric power needs of this growth center. Other significance attached to this highly regarded potential project is the range of water needs it can satisfy in the 0-1 portion of the growth center and the downstream Greater Wheeling-Steubenville Regional Growth Center.

*/ See also Part III, Chapter 11; Potential St. Petersburg Reservoir.

Beaver River Basin

Subdivision B-1

Entire Shenango River Basin

Growth Centers: Primary: Sharon-New Castle(-Meadville), Pa.,
and Youngstown, Ohio */.

Sharon-New Castle. Warren-Youngstown */ and Sharon-New Castle (-Meadville) growth centers converge at New Castle. Progress of this expanding growth center, contiguous to the Pittsburgh Regional Growth Center, will be impaired if water resources development for prevention of flood damage, for water supply and water quality improvements are not provided. Growth will be slowed in the lower end of New Castle by flood damages from the left bank tributary of Neshannock Creek. Current annual flood damages from this source are about \$101,000, over extensive industrial, commercial, and residential developments along the lower 2 mile reach of the creek. Future urban land use will require protection of at least 150 acres of flood plain lands at New Castle. Upstream flood plain lands, about 1,600 acres, will also require flood protection. Current annual flood damages in this area approximate 25,000 dollars. There appears to be no immediate need for water quality improvements in the Neshannock Creek area of the growth center. In the future, water quality improvements will be needed to support continued and accelerated industrial diversification and readjustment in the industrial mix. At New Castle, industrial potential, in addition to steel, now includes potential for glass, paper, ceramics, chemicals, fabricating, food, plastics, printing and lumber industries. Industrial development requires expanded water resources development of storage capabilities at Grand River */ and Neshannock Creek projects, and supplemental alternative additional surface storage in the contiguous Slippery Rock Creek and Connoquenessing Creek watersheds. To meet the various needs at New Castle by 2020, and needs of other communities upstream including Mercer and New Wilmington, there are alternatives including channel improvement at New Castle, three relatively large reservoirs on West Branch Little Neshannock Creek, Little Neshannock Creek, and Otter Creek and development of nine upstream watershed reservoirs. Withdrawals from the larger alternatives could yield about 12 cfs, 8 cfs and 13 cfs, respectively. The broad flood plain along the main stem of the Shenango River, below Shenango Dam, through Sharon, South Sharon, West Middlesex, Pulaski, to New Castle has in excess of 1,000 acres of developable industrial-oriented lands needed for future urban use. Adequate flood protection is provided by existing Shenango River Reservoir. Water supply and water quality improvements needed for growth in the Shenango River area above New Castle are also provided by the existing reservoir. Water related recreation demands for the growth center by 2020, of 21.0 million visitor-days will

*/ Non-Appalachian.

only be partially supplied by existing Pymatuning, Shenango River, Mosquito Creek, West Branch, Milton, Berlin, and Meander Reservoirs. A water related recreation facility at Grand River project would have the capacity for 8.25 - 13.75 million visitor-days. Reservoirs near the New Castle area will also be needed to augment the existing and future water based recreation facilities by 2020. The authorized Little Shenango River Upstream Watershed Project in the Greenville area, expected to be in operation by 1980, will reduce flood damages and provide some water related recreation in that area.

Subdivision B-2

Entire Beaver River Basin exclusive of Shenango River Basin.

Growth Centers: Primary: Warren-Youngstown Beaver Basin portion of Greater Pittsburgh Regional.

Warren-Youngstown. Water related problems constrain the non-Appalachian Warren-Youngstown growth center at the Sharon-New Castle growth center and the Greater Pittsburgh Regional Growth Center. Problems include flooding, lack of water supply and poor water quality. Residual annual flood damages amount to about \$40,000 along the lower Mahoning River and the Beaver River. About 104 mgd */ for municipal and industrial water supply and about 350 cfs for water quality improvement purposes will be needed by this growth center prior to 2020. Even with implementation of previously authorized impoundment sites, except for the authorized Eagle Creek site, another impoundment project in the contiguous Grand River Basin must be provided. With a potential Grand River impoundment operating in a system (combined with Berlin and Mosquito Creek Reservoirs) annual flood damages would be reduced to about \$81,000 in the growth center and to about \$10,000 along the main stems of the Mahoning and Beaver Rivers to the Ohio River. Although the authorized Eagle Creek Reservoir is a lesser alternative, not expected to be in operation by 1980, it will be required to provide additional needed flood protection (and other needs) for the growth center. An alternative Grand River impoundment (the Harpersfield Site) could include development of a 600,000 KW pumped-storage hydroelectric peaking facility, water for transfer to the Cuyahoga River for Akron water supply, for low-flow augmentation, and water based recreation capabilities for handling 13.75 million visitor-days. Another alternative impoundment (the Grand River Site) would eliminate pumped-storage power, but would have the water (through transfer) for Akron, and water based recreation capability to handle 8.25 million visitor-days. Water supply potential at the Harpersfield Site would exceed that of the Grand River Site, providing widespread satisfaction of water supply needs, including headwater Shenango River needs of about 10 mgd. The substantial recreation capabilities of the above alternatives will be needed to satisfy both sub-regional water related recreation demands, estimated at about 251.0 million visitor-days and growth center needs. A suggested

*/ Grand River Reservoir Study; 1969;
Average summer release valve to 2020 will depend on interstate dissolved oxygen requirements.

wild and scenic river project on contiguous Little Beaver River will be studied for possible need by 1980.

Greater Pittsburgh (Beaver). The water related problems of this portion of the Pittsburgh growth center will impair growth in the Beaver County drainage area along the Beaver River and in Butler County and Beaver County drainage area along its principal tributary, Connoquenessing Creek. These include flooding, lack of water supply, poor water quality and environmental degradation. The flood damage problem occurs along Connoquenessing Creek, above and below protected areas in the City of Butler. Current annual flood damages approximate \$226,000 and affect industrial growth at East Butler, Renfrew, Zelionople and Ellwood City (North Sewickley Township area). Flooding also occurs on the Beaver River at its mouth from about Wampum to below Beaver Falls, where current annual flood damages amount to about \$40,000, affecting industrial growth along the Beaver River. Upstream watershed annual flood damages, from tributaries of Slippery Rock Creek and Little Connoquenessing Creek, are not currently significant, amounting to about \$5,000. A need is anticipated for approximately 500 additional acres of flood plain lands for urban use by 2020. Water supply needs for this area are estimated at 4,670 mgd by 2020. These needs could be met by the existing Allegheny River reservoirs, above the point of intake for Butler (by water transfer amounting to about 5.5 mgd from the Allegheny River) the St. Petersburg Reservoir Project (as part of the future Allegheny River supply), Connoquenessing Creek tributary reservoirs on Glade Run and Little Connoquenessing Creeks; existing Mahoning and Shenango River reservoirs, a Grand River impoundment project and authorized Eagle Creek reservoir; all supplemented by watershed possibilities and potential channel improvement extension upstream and downstream of the existing Butler local flood protection project. Water based recreation needs for this area are estimated to be about 50 million visitor-days by 2020. These needs can only partially be met by expansions of existing reservoir facilities and from the Moraine State Park Recreational Area. Additional requirements are: Connoquenessing Creek developments; Connoquenessing Creek upstream watershed developments; a water based recreation area on Buffalo Creek in southeast Butler County; the Alameda Park area along Sullivan Run (tributary to Connoquenessing Creek in Butler) which may be completed by 1980; a park area on Sarver Run near Saxonburg; and a regional park - scenic river project on Little Beaver Creek to the west. Water quality improvement needs are estimated at about 60 cfs for the City of Butler by 2020. Both Beaver and Butler Counties have extensive coal mining affecting this growth area which will necessitate water quality improvements and reclamation of about 25,000 acres to restore and enhance environmental possibilities, and to provide land for future urban use.

Ohio River Basin

Subdivision O-1

Head of Ohio River (Pittsburgh) to Ohio River Mile 127.2, excluding Beaver River Basin.

Growth Centers: Greater Pittsburgh Regional Growth Center;
and Greater Wheeling-Steubenville Regional
Growth Center.

Greater Pittsburgh-Wheeling (Ohio River). The most serious water related problem which may impair growth along the Ohio River reach encompassing the Pittsburgh-Wheeling areas, is flooding. Current flood damages amount to about \$2,000,000 divided almost equally between the Pittsburgh and the Wheeling areas. By 1980, the Rowlesburg Lake will reduce these main stem damages by about \$500,000, so the growth restraint will still exist. More than 3,000 acres of flood plain lands will be needed for urban uses along the Ohio River and about 1,500 acres along Chartiers and Raccoon Creeks by 2020. Water supply needs along the main stem will be amply supplied from the Ohio River flow for 2020 demands. Water quality storage for about 1,600 cfs additional dependable flow will be required to meet future quality improvement needs along the Ohio River near Pittsburgh. This need will not be met by the existing and authorized reservoir system. The Pittsburgh-Wheeling growth centers are expected to have a demand for water oriented recreation of some 279.0 million visitor-days in excess of present, and 1980, facilities in the Pittsburgh-Wheeling area. Total sub-regional water based recreation demand of 571.1 million annual visitor-days is expected by 2020. Part of this demand, 251.0 million visitor-days, will be attributable to the five-county Pittsburgh growth center. Alternatives considered in the Studies of the Allegheny, Monongahela and Beaver River Basins, in and affecting Sub-region F which would best contribute to meeting the massive water related needs of the Pittsburgh-Wheeling Upper Ohio River and downstream Regional Growth Areas are:

- a. For flood control and development of flood plain areas - Potential multiple-purpose St. Petersburg (Clarion River), Big Sandy Creek, Dunkard Creek, Grand River, Laurel Hill Creek, Ten Mile Creek, and Raccoon Creek Reservoirs;
- b. For water quality control - Multiple-purpose St. Petersburg Reservoir (Clarion River);
- c. For water oriented recreation - Above listed reservoirs supplemented by other potential multiple-purpose reservoirs and developments discussed herein including recreational and scenic river developments, parks, forest, etc., and

- d. For peaking power - Potential St. Petersburg Reservoir and potential system of other pumped storage and conventional hydroelectric power developments on the Cheat River, Youghiogheny River, Slipper Rock Creek, Buchannon-West Fork River, Tygart River, Mahoning Creek, Tionesta Creek - Clarion River and Grand River - Mahoning River.

Lake Erie and Lake Ontario Basins

Subdivision E-1

Entire Cattaraugus Creek Basin

Growth Centers: Secondary: Gowanda, New York.

Gowanda. The water related problems of this secondary growth center include flooding, lack of water supply, and poor water quality. Current annual flood damages to property amount to about \$31,000 from Cattaraugus Creek in the village of Gowanda. In addition, annual national account losses amounting to \$462,000 would be suffered by Gowanda if a damaging flood caused two major industries to relocate their plants. There will be little need at Gowanda for more than affected flood plain land for urban uses by 2020. Below Gowanda, future agriculture-rural land needs appear to be for about 14,600 acres. Estimated irrigation water supply needs for this area will require 25 cfs by 2020. Should industrial development be induced, this land could be converted to urban use. Maintenance of stream quality by 2020 will require storage with a maximum dependable yield of about 244 cfs. Water oriented recreation needs are estimated to be about 2.2 million visitor-days per year by 2020. It is also estimated that by 1990 the peak demand for electrical energy will increase 13 gigawatts */ , and the energy consumed annually will increase 76 gigawatt */ hours. These needs can be met by a local flood protection project at Gowanda and multiple-purpose reservoir impoundments in Cattaraugus Creek Basin, such as Otto and Springville.

Subdivision E-2

Direct drainage to Lake Erie in Pennsylvania and New York, excluding the Cattaraugus Creek Basin.

Growth Centers: Primary: Erie-Lake Erie.

Erie-Lake Erie. Water related problems of this primary growth center include those of the Pennsylvania-New York lake shore area with direct drainage to Lake Erie and are: flooding, navigation hazards and lack of a refuge harbor, water supply, water quality, sediment, drainage, and beach erosion control. The principal need is for refuge harbor facilities and navigation improvements for light-draft and commercial vessels. Supplying these needs will facilitate growth at coastal harbors, including the large commercial and recreational potential associated with boating and fishing activity along Lake Erie. It is expected that continuing studies of small-boat harbor needs will be completed, required

*/ Gigawatt = 1,000 Kilowatts

authorizations obtained, and implementation initiated of a variety of facilities for this chain of refuge harbors by 1980. These projects will be required along the Lake Erie coast at unique tributary point sites that have capabilities for harbor development in this growth center, such as: Elk Creek, Walnut Creek, Erie, North East, Lake Erie State Park, Dunkirk and Cattaraugus Creek. Projects for Elk Creek and at the mouth of Cattaraugus Creek have been authorized. Drafts of survey reports have been submitted for North East and Dunkirk. A final draft of survey report has been submitted for Lake Erie State Park. Beach erosion needs exist along about 5.4 miles of shore line, mostly at Presque Isle. Study and implementation of restorative measures are expected by 1980. Annual flood damages at Conneautville, Pa., currently amount to about \$16,400 from Conneaut Creek and can be reduced to about \$3,700 by a single-purpose small earth dam and reservoir project supplemented by two culvert modifications. It is expected that these projects will be implemented by 1990. Urban land use needs by 2020 can be met from existing developable land, with minor addition through flood protection at Conneautville. The growth center will require some additional municipal and industrial water supply and water quality improvements by 2020. Sediment and drainage problems are minor and are expected to remain so with adequate water surveillance, study and control by 1980. Water oriented recreation needs for the growth center by 2020 of about 35.0 million visitor-days per year will be partially met by existing and proposed Lake Erie facilities, with the aid of refuge harbors, contiguous existing French Creek reservoirs, and other existing and proposed facilities in contiguous Conewango, Cattaraugus and Genesee River Basins. Electrical power needs by 2020 are estimated to increase in the growth area. Hydropower needs are estimated to be 5,700 megawatts at 2020, of which 1,100 megawatts are expected to be met by 1980, an additional 1,900 megawatts by 1980-2000, and an additional 2,700 megawatts by 2000-2020. These needs will be partially met by private and public hydropower developments in contiguous basins.

Subdivision G-1

Entire Genesee River Basin, draining to Lake Ontario.

Growth Centers: Primary: Hornell-Wellsville (portion).

Hornell-Wellsville. The water related problems at Hornell-Wellsville, in the headwater areas, respectively, of the Susquehanna and Genesee Rivers, include flooding and lack of sufficient water supply, and water quality to support growth. Residual annual flood damages currently in Wellsville amount to about \$24,000, from the Genesee River and Dyke Creek, even with a limited capacity channel improvement project in operation and an expected, by 1980, authorized extension and modification of the existing project. Municipal and industrial water supply needs for the growth center are estimated to be 10 mgd by 2020. Irrigation water needed by 2020 is estimated at 30 mgd. Water quality improvements, to be met by flow augmentation, will amount to about 60 cfs by 2020. A daily flow of 95 cfs, needed

for projected industrial development, will mainly meet these needs. Water supply needs for supplemental irrigation are required on approximately 5,800 acres of prime agricultural land along the Genesee River in Allegany County below Wellsville. Some of the acreage along the Genesee River and about 100 acres of flood plain land at Wellsville will be needed for urban uses by 2020. Wellsville area recreation needs are estimated to be about 2.0 million visitor-days. All the above Wellsville growth area needs, as well as substantial portions of downstream needs, could be met by the potential Stannard Reservoir project and associated development. Part of the peak electrical power needs for this growth center, including Hornell in the contiguous Susquehanna River Basin, could be supplied from the potential Stannard Reservoir in combination with the potential Portage Reservoir.

SECTION IV - EVOLUTION OF SUB-REGION PLAN

12. SELECTION OF BEST SOLUTIONS

Water resource needs for the principal growth centers are described in Section II by state planning areas and major river basins in Sub-region F. Potential water resources developments for meeting these needs were derived from the framework study of alternatives and are described in Section III. The project alternatives discussion also indicates compatibility with authorization through existing Federal agencies (Corps of Engineers, Department of Agriculture, etc.), the planned programs of the states, counties, regional planning commissions, or other governmental agencies and private programs. The total structural or non-structural alternatives of all of these agencies are not known or available at this time for complete presentation or review. Water needs and water resource development alternatives were defined to facilitate selection of the best apparent plan to satisfy the more obvious, presently definable, needs. The water report states water needs in comparison with existing and potential alternative supplies. This provides the reader with an overview of needs which presently appear to constrain economic development and growth of each growth center. Because this plan will satisfy needs apparent now, a continuation, and revision, of this study should be programmed.

Alternative solutions to the water needs of sub-region growth centers are discussed below. Diagrams accompany descriptions, showing: the relative location; existing and potential projects which can satisfy needs; flood control storage provided, including that from additions to the existing system; storage capacity and minimum dependable flow for water supply; and, in some cases, water quality storage expected to become available.

It is assumed that: (1) presently programmed and authorized studies and implementation of presently authorized projects will continue to 1980, the point of departure from historic to projected (benchmark) development; (2) water, sufficient to supply the 1980 needs, will be provided; and (3) other needs can be satisfied from existing and potential storage impoundments by selection of alternatives and considering recorded minimum natural low flows issuing as minimum releases from all reservoirs.

Allegheny River Basin */

Subdivision A-1

The two primary and three secondary growth centers in this reach of the Allegheny River, from the headwaters to Franklin, Pa., are

*/ See Figures 12-21 and 12-22 for additional features discussed by subdivisions of basin.

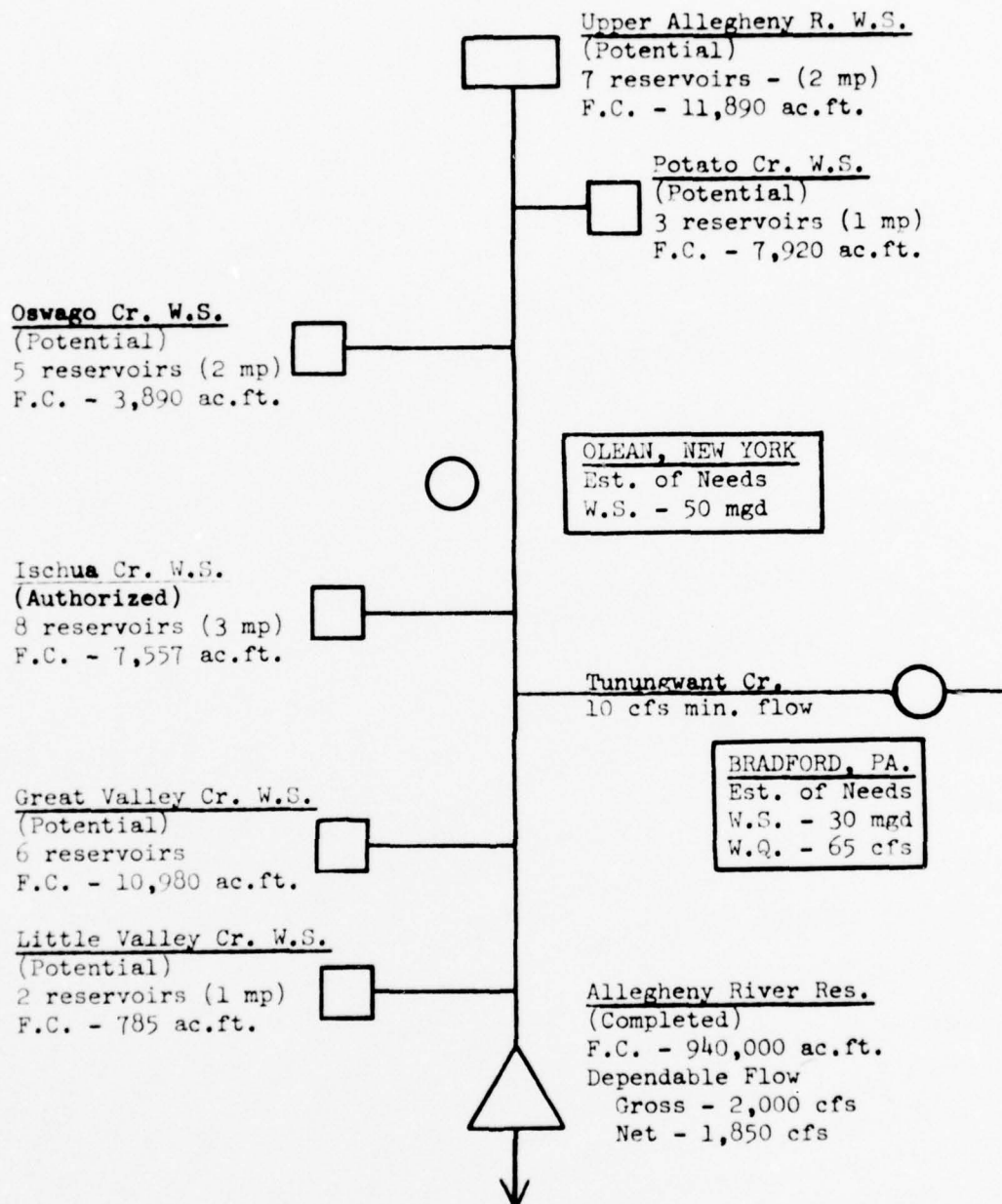
discussed in the following order downstream from the headwater reach: Franklinville, Coudersport, Olean-Bradford, Jamestown-Warren and Oil City-Franklin.

Olean-Bradford, Franklinville, Coudersport. (See Figure 12-11.) Flood damage throughout the river reach from Coudersport through Salamanca to the head of Allegheny Reservoir will be minimal due to local flood protection projects operative by 1980 at Olean, Portville and Salamanca, and the fact that unprotected flood plains are not developed. Bradford, on tributary Tunungwant Creek, is also adequately protected within its existing developmental area. Although a flood protection need is not indicated at these urban locations, current annual flood damage in upstream rural areas of Subdivision A-1 approximates 125,000 dollars. Consequently, extensions to existing local protection projects are needed for future urban land use and to reduce damages to rural areas. There are reserved ponding areas integral with the existing local protection project in Olean, N.Y., which provide some room for expansion if converted to urban land use. Studies will be required to determine the economic contribution of this possibility and the magnitude of project extensions needed subsequently at individual locations in the area.

The City of Bradford has a problem of water supply and stream flow to assimilate residual wastes after secondary treatment. This problem requires additional study in view of potential storage site paucity in this area. Five potential upstream watershed projects in the Upper Allegheny River Basin, designed to eliminate about \$94,000 of upstream rural area flood damages, could possibly be expanded to include water supply for the City of Bradford. Additional water supply could be obtained from Allegheny River Reservoir or the Allegheny River through a possible pipeline to points of needs.

Jamestown-Warren. (See Figure 12-12.) Annual flood damage of about \$470,000 occurs to developmental points around the shores of Lake Chautauqua and its outlet, and along the Chadakoin River through Jamestown and Levant, N.Y. to the mouth of Cassadaga Creek. Land, in the intervening reaches, presently unused but needed for future urban use, also will require protection. Annual flood damage approximating \$236,000 occurs on agricultural lands currently producing high grade vegetables for urban markets.

Protection against Lake Chautauqua and Chadakoin River overflows can be provided by the following alternatives: (1) an authorized Corps of Engineers diversion - storage local flood protection project involving seasonal regulation of Lake Chautauqua and outflows to the Chadakoin River via Warner Dam (including its reconstruction) and a diversion, via Little Chautauqua and Chautauqua Creeks through Westfield and Barcelona, to Lake Erie; (2) USDA upstream watershed impoundments for seasonal storage for recreation and for lake regulation (currently under study in the tributary lake area); and (3) local protection measures extending



ALLEGHENY RIVER BASIN ABOVE
WARREN, PA.

Figure 12-11

Cassadaga Cr. Res.
(Potential)
F.C. - 45,500 ac.ft.
Dependable Flow
Gross - 66 cfs
Net - 51 cfs

Lake Chautaugua, L.P.P.
(Potential)
F.C. - (Note)
Dependable Flow
Gross - 20 cfs
Net - 10 cfs

Stillwater Cr. Res.
(Potential)
F.C. - 18,100 ac.ft.
Dependable Flow
Gross - 42 cfs
Net - 32 cfs

JAMESTOWN, N. Y.
Est. of Needs
Current Flood Damage - \$470,000
W.S. - 180 mgd
W.Q. - 200 cfs
Land Development - 600 acres

Conewango Cr. Res.
(Potential)
F.C. - 76,000 ac.ft.
Dependable Flow
Gross - 152 cfs
Net - 130 cfs

Totals from Conewango Cr. Basin
F.C. (Existing) - 0
F.C. (Potential) - 139,600 ac.ft.
Dependable Flow
Gross (Existing) - 57 cfs
Gross (Potential) - 270 cfs
Net (Existing) - 0
Net (Potential) - 223 cfs

(Note) - Flows in excess of 1,000 cfs
diverted to Lake Erie.

CONEWANGO CREEK BASIN

Figure 12-12

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from the lake outlet along the Chadakoin River through Jamestown and Falconer to Cassadaga Creek, supplemented by seasonal lake regulation. Of these alternatives, only the diversion project would completely eliminate current and future flood damages.

Future needs of this growth center consist of an additional 158 mgd for water supply and a minimum low flow in Cassadaga Creek of 185 cfs to assimilate residual waste after secondary treatment at Jamestown. Importantly, flood protection is needed for 600 acres of prime industrial development land at the upper end of Lake Chautauqua and in the lower Chadakoin River and Conewango Creek valleys. Reservoir projects on upper Cassadaga, Conewango, and Stillwater Creeks would contribute protection to this developable land while providing needed water supply and stream flow augmentation.

More detailed study of the entire Conewango Creek Basin is needed to firmly establish priority needs and best solutions.

Oil City-Franklin. (See Figure 12-13.) With control of the Allegheny River, effected by Allegheny River Reservoir and a local protection project on Oil Creek at Oil City, there is no appreciable flooding constraint to economic development. Water supply and quality are adequate from assured flows in the Allegheny River.

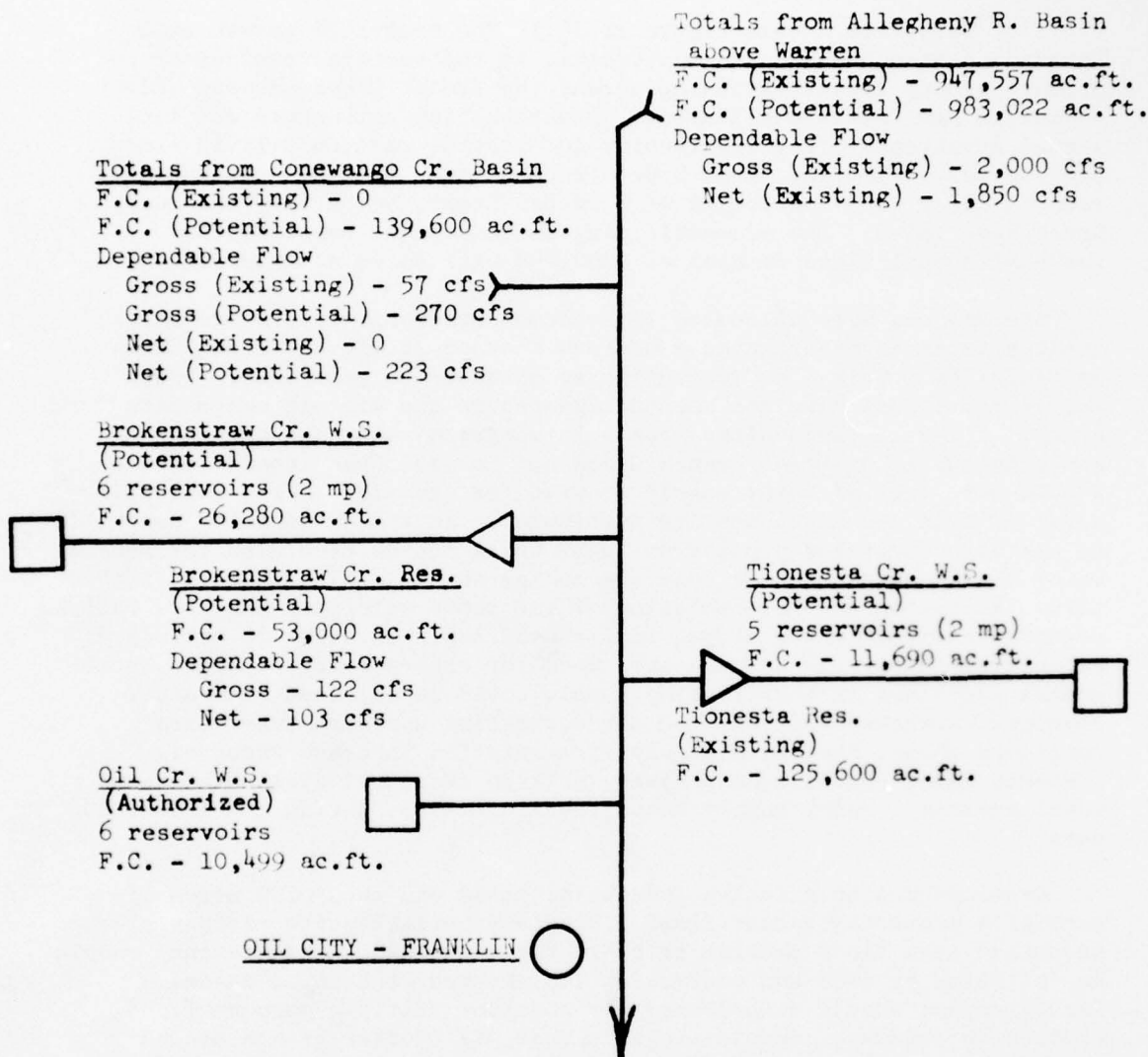
An opportunity for partially satisfying the sub-regional water oriented recreation demand exists in the contiguous Allegheny River valley. Expansion of facilities and scenic developments are needed along the river at this growth center and in the Jamestown-Warren growth center upstream (including Allegheny River Reservoir), and in downstream areas, including the potential St. Petersburg Reservoir in the Clarion River area.

The Commonwealth of Pennsylvania, Warren and Venango Counties, and Western Pennsylvania Conservancy are currently considering state park developments (Park of the Islands - 15,000 acres, opposite Allegheny National Forest. The Commonwealth of Pennsylvania, Department of Forests and Waters, had a public hearing on May 2, 1969, for the Allegheny River State Park. This new state park is located in Victory, Clinton and Scrubgrass Townships, Venango County and includes three distinct parcels of land totalling approximately 3,600 acres along the Allegheny River. Scenic river preservation possibilities in this and contiguous Allegheny and Clarion River reaches are under consideration. Some definite developments may be expected by 1980.

Subdivision A-2

Entire French Creek Basin.

The City of Meadville, part of the New Castle-Sharon-Meadville Primary Growth Center is located in the heart of the French Creek Basin. The schematic diagram shows growth center location with available and expected water supply.



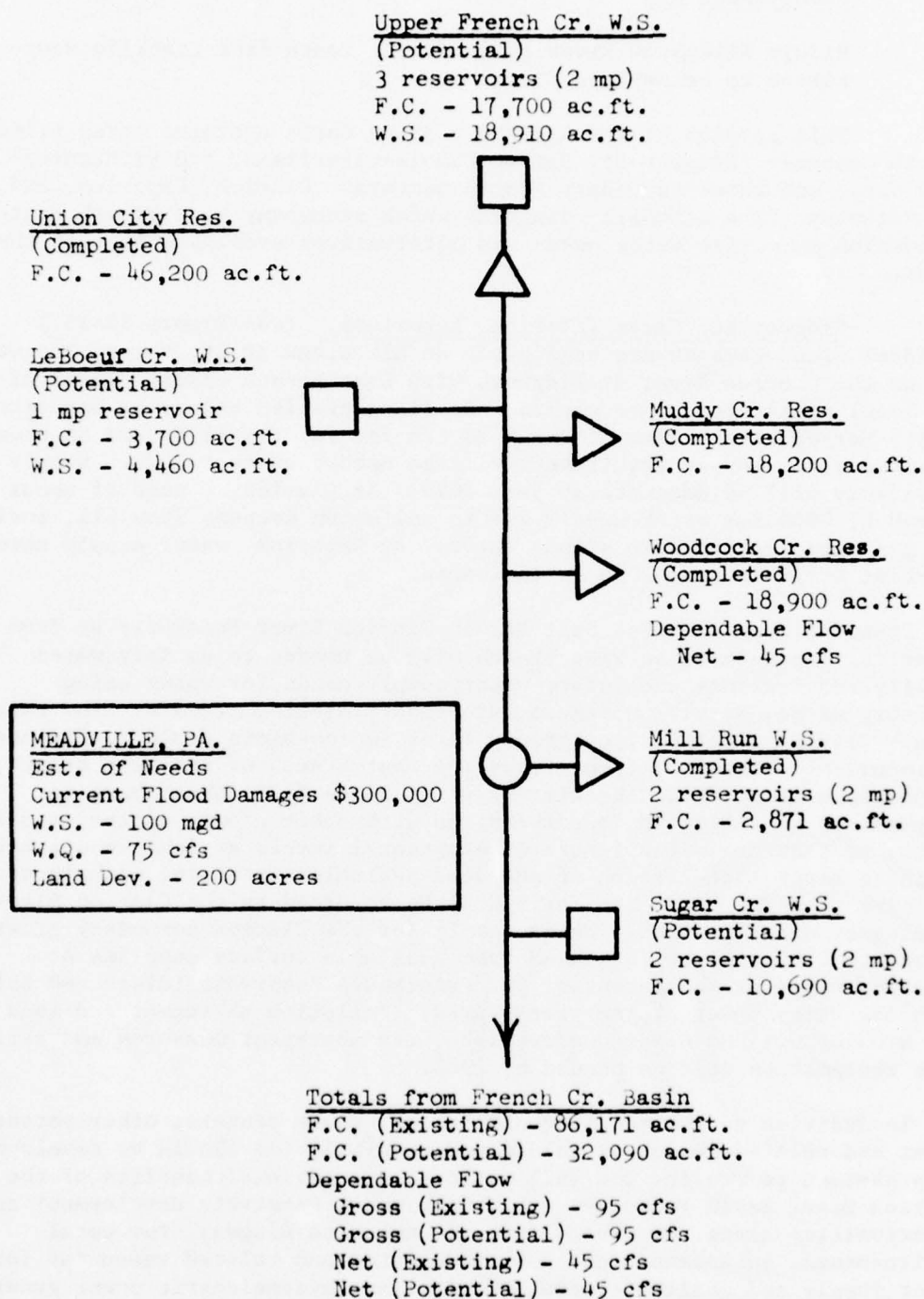
ALLEGHENY RIVER BASIN ABOVE
 FRANKLIN, PA.

Meadville. (See Figure 12-14.) The Meadville growth area, located on French and Cussewago Creeks, is the eastern terminus of the primary growth center extending across the French Creek-Shenango River divide to New Castle and Sharon. Resources, infrastructure and locational advantages offer opportunity for growth, particularly in flood plain areas. Flooding, from Upper French Creek, will be substantially reduced after 1980 completion of Woodcock Creek, Union City and Muddy Creek Reservoirs. The schematic diagram indicates, however, that residual annual flood damages of \$300,000 will occur at Meadville.

Storage has been allocated in Woodcock Reservoir to provide water quality releases maintaining a minimum flow of 75 cfs in French Creek at Meadville. This flow is considered adequate to year 2020. Water supply provisions have not been designated in the storage components of this triad of reservoirs. Possible upstream watershed projects above Meadville at Upper French Creek and LeBoeuf Creek could include 23,000 acre feet of water supply storage for transfer to the Lake Erie area, at Erie and North East in particular. In the basin below Meadville, an upstream watershed project on Sugar Creek has no provision for meeting water supply needs because none are indicated by local interests at this time. Rescoping and reformulation of the above watershed projects will be required eventually for proper time-phased implementation to satisfy stimulated industrial development needs for future water supply. Incremental additions to the existing supply could be obtained from other rescoped watershed sources, the three existing upstream reservoirs mentioned above, pumping directly from existing Shenango Reservoir, Conneaut Lake, the Allegheny River, or from excellent available ground water sources. Water supply needs require restudy during the 1980-2000 period.

Developments on existing industrial lands and about 200 acres of partially protected vacant flood plain lands will require restudy of the Meadville area flood problem prior to the year 2020. This restudy should be initiated by 1980 and protection implemented as soon as needed. Survey report should comprehensively consider multiple-purpose flood protection and water supply projects that will foster growth at and around the center at Meadville. It would be desirable, particularly, to strengthen the overall growth center, as well as to develop a recreation complex within the French Creek Basin. Creation, thereby, of a large integrated recreational area, throughout the total reach of French Creek, would advance objectives to make this area a special attraction to tourists and vacationists.

Protection for the immediate Meadville area along French and Cussewago Creeks requires survey report study of local flood protection measures covering reaches where there is potential for industrial and urban growth.



FRENCH CREEK BASIN

Figure 12-14

Subdivision A-3

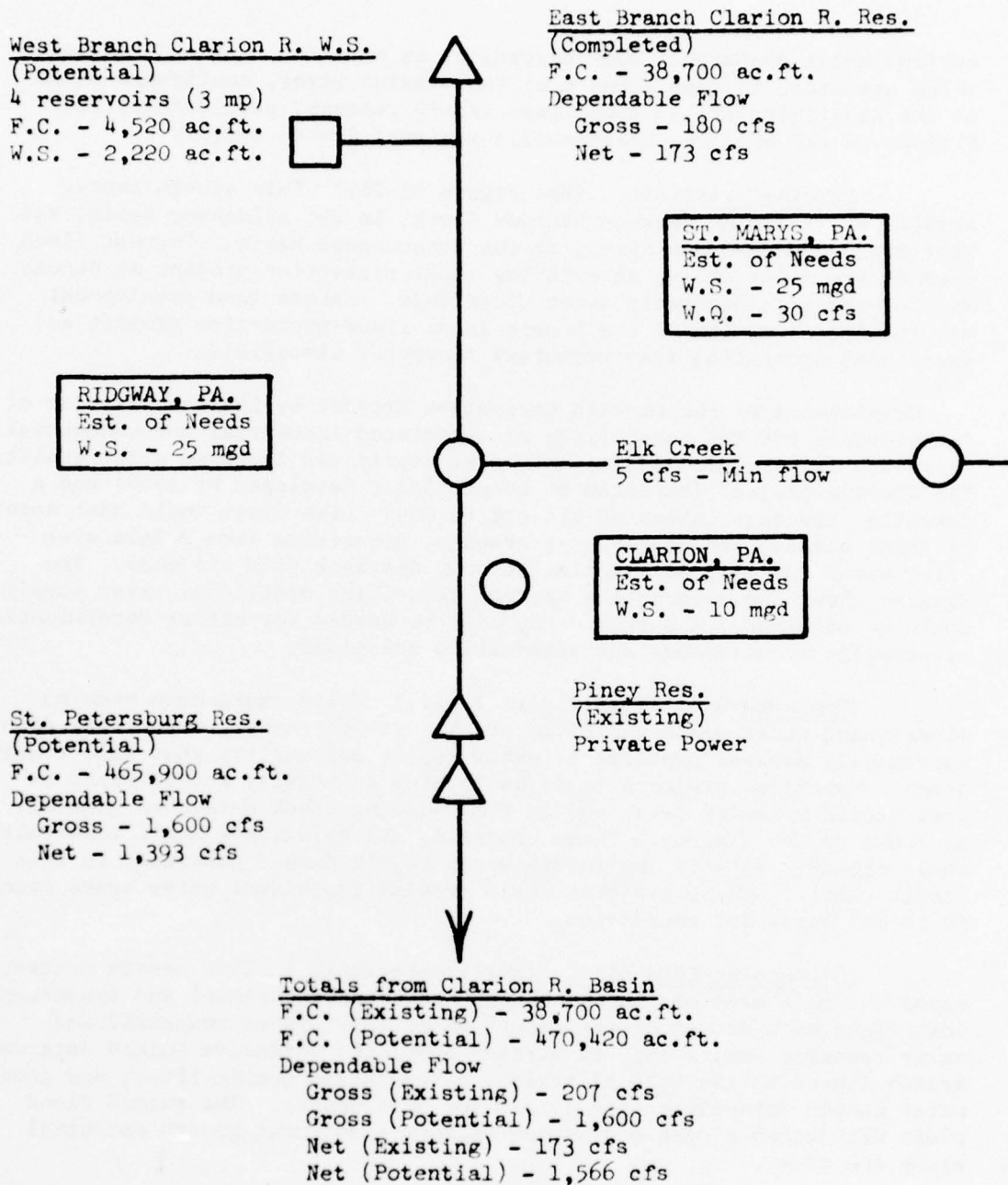
Middle Allegheny River Basin in the reach from Franklin downstream to below Ford City.

This portion of the Allegheny River Basin contains three primary growth centers: Ridgway-St. Marys, DuBois-Clearfield, and Kittanning-Ford City; and three secondary growth centers: Clarion, Emporium, and Punxsutawney. The schematic diagrams which accompany each growth center discussion summarize water needs and alternatives available to meet the needs.

Ridgway-St. Marys (Clarion, Emporium). (See Figure 12-15.) Residual flood damages are negligible on Elk Creek at St. Marys, Ridgway, and on the Clarion River at Ridgway, with East Branch Clarion Reservoir and local protection improvements. No flood problem exists at Emporium. At St. Marys, stream flow of about 30 cfs for water quality and an undetermined water supply requirement will be needed by year 2020. Supply at Ridgway will be adequate at year 2020. At Clarion, a need of about 10 mgd at 2020 for water supply due to pollution seepage from oil, coal and gas exploitation into ground water. At Emporium, water supply need of about 4 mgd in year 2020 is indicated.

Transfer from existing East Branch Clarion River Reservoir or from potential impoundment on West Branch will be needed to satisfy water quality requirements and future water supply needs for water using industry at St. Marys. Upstream watershed projects, transfer from East Branch Clarion Reservoir, or ground water improvements could supply needs at Emporium. Transfer, from either the East Branch or the West Branch, is possible if needs in the Clarion River reach from Johnsonburg to Ridgway can be satisfied in combination with other growth center requirements, or that needs for future developmental levels at Johnsonburg will diminish after installation of advanced pollution treatment techniques. Supplies transferred to St. Marys will be returned to the Clarion River at Ridgway via Elk Creek. Water supply for the Clarion secondary growth center by 2020 will be furnished from available surface supplies at existing Piney or the potential St. Petersburg Reservoir (discussed below) with the Piney power project recaptured. Pollution abatement and land use studies will be needed before 1980, and abatement measures and strip mine reclamation will be needed by 1980.

In addition to the requirements of the growth centers, other potential water and related resources values and possibilities should be developed or preserved to realize the full national and regional benefits of the Clarion River Basin resources. St. Petersburg Reservoir development and opportunities along the river, from its mouth to Ridgway, for total environmental enhancement could provide water and related resources for: water supply and quality control; navigation; hydroelectric power generation; land development; economic development; preservation and use of



CLARION RIVER BASIN

Figure 12- 15

environmental resources; and recreation, in addition to flood control. These are vital to the economy of the Clarion River, contiguous areas of the sub-region and to downstream growth centers, particularly the Pittsburgh and Wheeling-Steubenville regional growth centers.

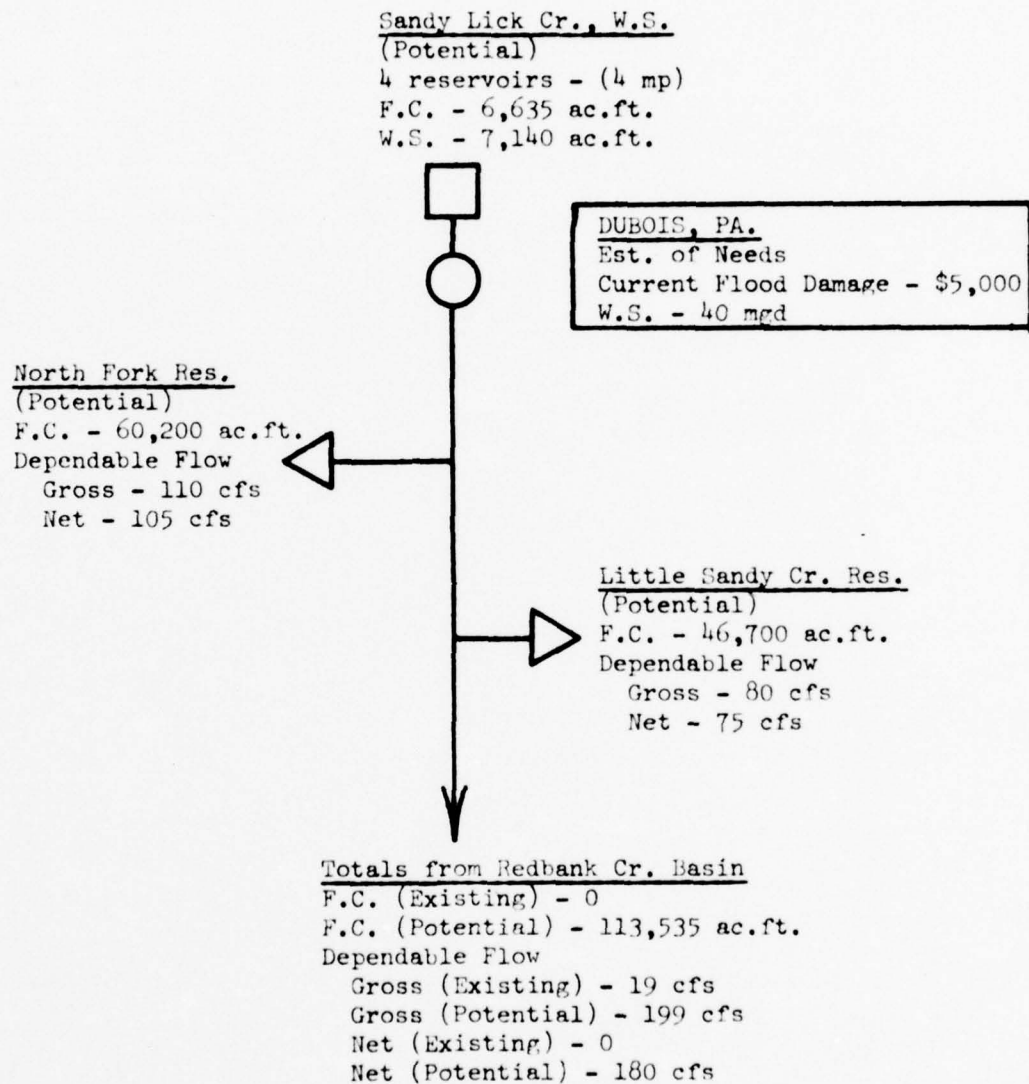
DuBois-Clearfield. (See Figure 12-16.) This growth center straddles the divide between Redbank Creek, in the Allegheny Basin, and West Branch Susquehanna River, in the Susquehanna Basin. Current flood damages are minor due to an existing local protection project at DuBois and Curwensville Reservoir above Clearfield. Future land development may require extension of the DuBois local flood protection project and additional protection from tributary flows for Clearfield.

Development of the Otocsin Recreation Project by the Commonwealth of Pennsylvania and the possibility of associated industrial and commercial expansion will require additional water supply and improved water quality. The Otocsin project (expected to be partially developed by 1980) and a potential upstream watershed project in Sandy Lick Creek could meet some of these needs. Two possible reservoirs, downstream from DuBois also offer water supply possibilities at some distance from the need. The diagram shows the alternative sources from which additional water supply could be obtained. A survey study will be needed for better determination of specific requirements and alternative solutions.

Punxsutawney. (See Figure 12-17.) While there have been no significant water needs exhibited at this growth center, industrial development will present problems of water supply and quality that will require study. Potential projects could be located at heavily wooded sites on East Branch Mahoning Creek and in the Mahoning Creek Watershed generally, as shown on the diagram. These projects, all relatively small reservoirs, could probably satisfy any future water supply demand generated in this growth center. These projects could provide individual water areas from 50 to 665 acres for recreation.

Kittanning-Ford City. (See Figure 12-18.) This growth center, along the main stem of the Allegheny River, has locational and resources advantages with extraordinary growth potential. Major underutilized water resource assets are, an already developed extensive inland waterway system linked to the Gulf of Mexico, a recognized scenic river; and good water supply uniquely suited to a major development. The rugged flood plain with steep slopes and narrow valleys constrains growth potential along the river.

Inducement of economic development is water related to growth up-river and down-river from Kittanning-Ford City. Studies to determine the nature of the inducement (associated with additional water and related resource developments such as flood protection, river transportation, and recreation) indicate that the best opportunities lie along the Allegheny River reaches in Armstrong County, augmented by the natural beauty of the river and the countryside.



REDBANK CREEK BASIN

Figure 12-16

East Branch Mahoning Cr. Res.
(Potential)
F.C. - 24,300 ac.ft.
Dependable Flow
Gross - 57 cfs
Net - 55 cfs

Mahoning Creek W.S.
(Potential)
3 reservoirs (1 mp)
F.C. 9,080 ac.ft.

Mahoning Cr. Res.
(Existing)
F.C. - 69,700 ac.ft.



<u>PUNXSUTAWNEY, PA.</u> Est. of Needs W.S. - 6 mgd

Totals from Mahoning Cr. Basin
F.C. (Existing) - 69,700 ac.ft.
F.C. (Potential) - 103,080 ac.ft.
Dependable Flow
Gross (Existing) - 8 cfs
Gross (Potential) - 63 cfs
Net (Existing) - 0
Net (Potential) 55 cfs

MAHONING CREEK BASIN

Figure 12-17

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Totals from French Cr. Basin

F.C. (Existing) - 86,171 ac.ft.

F.C. (Potential) - 118,261 ac.ft.

Dependable Flow

Gross (Existing) - 95 cfs

Gross (Potential) - 95 cfs

Net (Existing) - 45 cfs

Net (Potential) - 45 cfs

Sandy Creek W.S.

(Authorized)

2 reservoirs (1 mp)

F.C. - 5,349 ac.ft.

Totals from Allegheny R. Basin
above Kittanning, Pa.

F.C. (Existing) - 1,283,576 ac.ft.

F.C. (Potential) - 2,160,336 ac.ft.

Dependable Flow

Gross (Existing) - 2,638 cfs

Gross (Potential) - 4,592 cfs

Net (Existing) - 2,068 cfs

Net (Potential) - 4,022 cfs

Totals from Allegheny R. above
Franklin, Pa.

F.C. (Existing) - 1,083,656 ac.ft.

F.C. (Potential) - 1,349,691 ac.ft.

Dependable Flow

Gross (Existing) - 2,184 cfs

Gross (Potential) - 2,510 cfs

Net (Existing) - 1,850 cfs

Net (Potential) - 2,176 cfs

Total from Clarion R. Basin

F.C. (Existing) - 38,700 ac.ft.

F.C. (Potential) - 470,420 ac.ft.

Dependable Flow

Gross (Existing) - 207 cfs

Gross (Potential) - 1,600 cfs

Net (Existing) - 173 cfs

Net (Potential) - 1,566 cfs

Totals from Redbank Cr. Basin

F.C. (Existing) - 0

F.C. (Potential) - 113,535 ac.ft.

Dependable Flow

Gross (Existing) - 19 cfs

Gross (Potential) - 199 cfs

Net (Existing) - 0

Net (Potential) - 180 cfs

Totals from Mahoning Cr. Basin

F.C. (Existing) - 69,700 ac.ft.

F.C. (Potential) - 103,080 ac.ft.

Dependable Flow

Gross (Existing) - 8 cfs

Gross (Potential) - 63 cfs

Net (Existing) - 0

Net (Potential) - 55 cfs

KITTANNING-FORD CITY

ALLEGHENY RIVER BASIN ABOVE
KITTANNING, PA.

Feasibility has been investigated*/ for locating a chemical and aluminum industrial complex at flood-free plant sites along the river. A chain of satellite industries and requisite commercial, residential, recreational, and other environmental enhancements could be forged from this complex. Additional study of the growth center's resources should be made to derive other water-related industrial possibilities requiring water transportation and a nearby source of electric power.

The scenic assets of the river, tremendous in extent are poorly used. Environmental improvements and water-oriented public-use facilities should be made integrated parts of the inducement process. Even if existing reservoirs in the growth center area were restructured for maximum recreation potential they would not furnish sufficient resources. Restructuring these would probably involve costs in excess of providing other water resource assets in the area. The environmental and resources advantages of the relatively large Clarion River Basin just upstream could be compactly developed for its potential. This development would markedly increase water and related resources available to the growth center and surrounding urban areas. A project analysis for this situation is contained in Part III, Chapter 11.**/

The growth center of Kittanning-Ford City is partially protected by a flood wall at Kittanning. The growth center experiences annual flood damage of about 60,000 dollars. Urban land use will require about 1,000 acres of unused flood plain lands extending along the river upstream to Reesedale and downstream to Freeport by 2020. There are no future water supply and quality needs with the assured flows in the Allegheny River shown on the diagram. Additional control of Allegheny River Basin tributary drainage upstream appears to be an alternative to achieve additional protection. Extending the existing flood wall at Kittanning would only furnish a minor portion of protection needed.

A multi-purpose water resource project on the Clarion River is a prime alternative for comprehensive flood protection of the entire Allegheny River reach and for direct support and enhancement of industrial and other developments along both the Allegheny and the Clarion Rivers.

Both the Allegheny River and the Clarion River, as part of the national wild and scenic river system, would be enhanced by the water

*/ Feasibility of Chemical Industry in Southwestern, Pa., E.D.A., U.S. Department of Commerce. Technical Assistance Project.

**/ Project Analysis, St. Petersburg Reservoir Project.

development plan. The designation of these rivers' compatibility of scenic and water resources development is expected by 1980. A potential Clarion River impoundment would reduce current annual flood damages of the growth center to about \$10,000 and reduce flood crests by about 3-4 feet over a wide range of flood occurrences, thus freeing the already limited flood plain lands for future urban use.

Subdivision A-4

Entire Kiskiminetas River Basin.

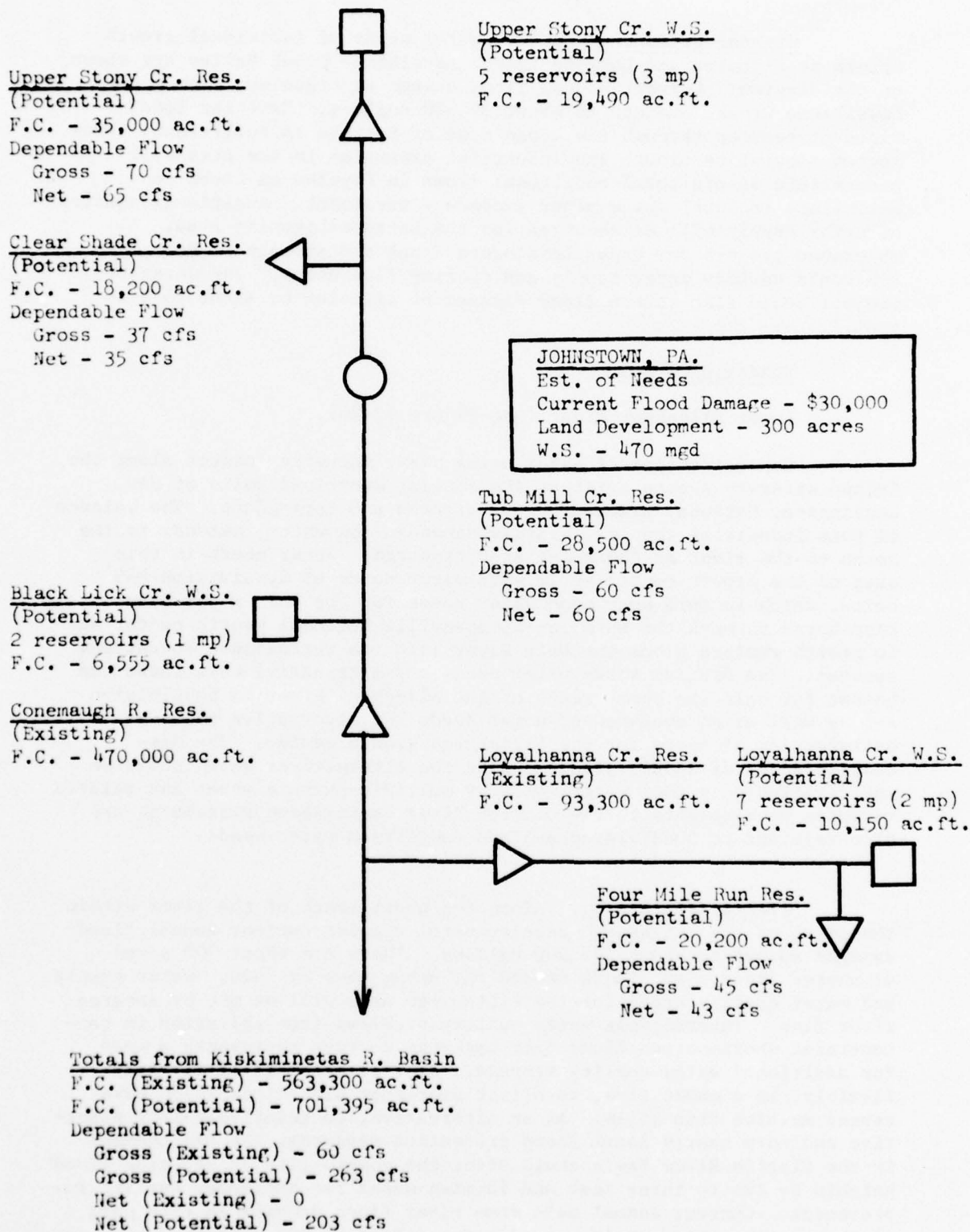
The diagrams show relative locations, water needs and alternative means to meet needs for the City of Johnstown (part of the Johnstown-Altoona Regional Growth Center), the Primary Growth Center of Indiana and part of the Pittsburgh Regional Growth Center.

Johnstown. (See Figure 12-19.) Flood damage from Stony Creek, Little Conemaugh River and Conemaugh River through the growth center has been substantially reduced within the reach of the existing local protection project. Upstream unprotected stream reaches, however, currently experience annual flood damages in the amount of about 30,000 dollars. In addition, about 300 acres of flood plain lands for projected urban use will require protection. By 2020, projected water supply requirements for the growth center are estimated to be about 470 mgd. Current supplies appear to offer about 320 mgd, leaving a deficit of 150 mgd. Area water is being degraded by surface and subsurface mining, from acid mine drainage, and industrial pollutants.

A Corps of Engineers study of the Conemaugh River Basin above the Conemaugh River Reservoir is currently underway and is expected to be completed before 1980. Two potential reservoirs are being considered on Clear Shade and Upper Stony Creeks, with an upstream watershed project in the Upper Stony Creek Basin (along with pollution abatement and land reclamation) would offer partial satisfaction of existing and projected needs. Additional studies are recommended to provide time-phasing of solutions. Extension of the existing local protection project in Johnstown should be studied.

Indiana. Major problems confronting this growth center by year 2020 will be lack of water supply and inadequate stream flows for quality. Projections indicate need for 70 mgd of water supply and 97 cfs of stream flow to assimilate residual wastes after secondary treatment.

Potential developments in Blacklick Creek watershed and an existing Pennsylvania Recreation Area impoundment on Yellow Creek offer possible alternative sources of future water supply. No sources of quality flows have been designated at this time. Further studies will be required to ascertain sources, needed degree of advanced waste treatment, and location of heavy effluent discharges to be guided to streams with adequate assimilative capacity.



KISKIMINETAS RIVER BASIN

Greater Pittsburgh (A-4). Water needs of individual growth points at Ligonier and Latrobe in the Loyalhanna Creek Valley are shown on the diagram. Current annual flood damage at Ligonier, from upper Loyalhanna Creek, amounts to about 37,000 dollars. Existing local flood protection through the urban area of Latrobe is sufficient. Projected population growth and industrial expansion in the area will necessitate 45 cfs total additional flows in Loyalhanna Creek to assimilate residual waste after secondary treatment. Additional sources of water supply will be required for the Latrobe-Ligonier area. A watershed project for Upper Loyalhanna Creek and storage in Four Mile Run could satisfy water supply and quality flow needs. The watershed project would also reduce flood damages at Ligonier by about 75 per cent.

Subdivision A-5

Lower Allegheny River (See Figure 12-20).

Concentrations of water using heavy industry located along the inland waterway system exist at the smaller municipal units of New Kensington, Natrona, Brackenridge, Tarentum and Springdale. The balance of this industrial complex, heavily dependent on water, extends to the mouth of the river at the Point at Pittsburgh. Water needs in this part of the growth center merge with water needs of Subdivision M-5 below, which in turn bear upon water needs for the Ohio River from Pittsburgh through the Wheeling-Steubenville Regional growth center and to growth centers along the Ohio River into its furthestmost downstream reaches. The diagram shows water needs and alternative ways these can be met for only the short reach of the Allegheny River in Subdivision A-5 as well as an overview of water needs and alternative means of satisfaction of needs for the Pittsburgh growth center. The discussion above of Subdivision A-3 with the alternatives which could be made available to meet water needs by multiple-purpose water and related resource developments in the Clarion River Basin above Pittsburgh are also relevant to Subdivision A-5 and downstream water needs.

Greater Pittsburgh. Along the short reach of the river within the total of the Pittsburgh developmental complex current annual flood damages amount to about 285,000 dollars. There are about 300 acres of unused flood plain lands needed for urban uses by 2020. Water supply and water quality needs for the Pittsburgh area will be met by assured river flow. Intermittent water quality problems from pollution in concentrated short-period flows from upstream sources represents a need for additional water quality storage. Storage needs to be released flexibly, in a short time, to offset emergency situations which have caused massive fish kills. As an alternative, to relatively less effective and more costly local flood protection measures, the impoundment in the Clarion River Basin could offer the possibility of reducing flood heights by two to three feet and furnish water for emergency quality improvement. Current annual main stem river flood damages in this part of the growth center would be reduced to about 70,000 dollars.

Totals from Allegheny River Basin
above Kittanning

F.C. (Existing) - 1,283,576 ac.ft.

F.C. (Potential) - 2,160,336 ac.ft.

Dependable Flow

Gross (Existing) - 2,638 cfs

Gross (Potential) - 4,592 cfs

Net (Existing) - 2,068 cfs

Net (Potential) - 4,022 cfs

Crooked Cr. Res.

(Existing)

F.C. - 89,400 ac.ft.

Totals from Kiskiminetas R. Basin

F.C. (Existing) - 563,300 ac.ft.

F.C. (Potential) - 701,395 ac.ft.

Dependable Flow

Gross (Existing) - 60 cfs

Gross (Potential) - 263 cfs

Net (Existing) - 0

Net (Potential) - 203 cfs

Totals from Allegheny River
Basin at Pittsburgh

F.C. (Existing) - 1,936,276 ac.ft.

F.C. (Potential) - 2,951,131 ac.ft.

Dependable Flow

Gross (Existing) - 2,990 cfs

Gross (Potential) - 5,147 cfs

Net (Existing) - 2,068 cfs

Net (Potential) - 4,225 cfs

PITTSBURGH, PA.

LOWER ALLEGHENY RIVER

Figure 12-20

Non-specific Growth Center Considerations

The preceding presentation of water resource investment alternatives for individual Allegheny River Basin localities obviously do not constitute a blanket evaluation of all area water problems which constrain economic growth. Needs thus are emphasized for developmental growth, where needs are shown to be relatively critical. The following paragraphs present a broader appraisal of needs for water resources necessary in view of the basin's predominantly rural character, relative underdevelopment of land resources, and sparse urban areas.

There are many instances, particularly in the upper river basin, of widespread tributary problems involving a large amount of rural flooding and some urban flooding, which can be best met by several USDA multiple-purpose upstream watershed projects under the PL 566 Program. A work plan has been developed for a number of rural communities and agricultural flood plain areas in upper Conewango Creek. Another is being considered for the Lake Chautauqua - upstream Chadakoin River area to provide flood protection and water conservation with summer recreation. The latter plan will incorporate the authorized Corps of Engineers' floodwater diversion project to Lake Erie via Westfield and Barcelona, using Chautauqua and Little Chautauqua Creeks as exists from the Allegheny River Basin. The preceding diagrams and the table below indicate other sites where such upstream watershed projects are in operation or underway. Although they are primarily for the development of small towns, they could supply water for headwater urban area. Great Valley and Little Valley Creeks in Cattaraugus County and the Upper Loyalhanna Creek Watersheds in Westmoreland County, described previously, are such particularly desirable upstream watershed projects.

Multiple water problems in the relatively undeveloped Cattaraugus Creek Sub-basin and a portion of the Upper Allegheny River Basin probably require survey consideration of alternatives to satisfy future demands anticipated by the State-local regional water resources planning board and the New York State Water Resources Commission.

The Pennsylvania local development district and Federal-State studies of upper river basin problems will specify many demands for water resource investments in the upper river area.

Recreation and electric power requirements and major water deficiency situations in the basin, not directly attributable to a specific growth center development, but still part of the sub-regional need, will require coordination with contiguous basin opportunities. Otocsin Reservoir and Recreation Area, and Naturealm in the adjacent Susquehanna River Basin, and other Pennsylvania recreation possibilities (at Yellow Creek near Indiana, Moraine State Park near Butler, and Buffalo Creek near Freeport), and New York's Allegany State Park are

all part of recreation opportunities in operation and underway in the Allegheny River Basin. The Appalachian Highland Interstate Recreation Complex would combine proposed St. Petersburg Reservoir, existing Allegheny River Reservoir and Allegheny National Forest in northern Appalachian core center development, to supplement state and private developments. Privately developed reservoirs for cooling steam plants and mine mouth power plants, such as at the Keystone site near Indiana, Pennsylvania, will offer alternative possibilities, for incorporation in a basin plan including water supply and recreation.

Water transfers, now developed at Butler, Pennsylvania, could utilize the Allegheny River for water supply (as part of a basin plan) although there is no present plan for such future use. Existing Allegheny River Reservoir and potential St. Petersburg Reservoir, supplemented by Cassadaga Creek developments would supply additional water within and outside the basin.

Hydroelectric power potentials are subject to this and other basin needs. Operating pumped-storage power at the Kinzua dam - Allegheny River site could be supplemented by the St. Petersburg Reservoir power potential, and other power potentials in the Cassadaga Creek-Lake Erie Basins. These could support on-site industrial and commercial developments. Accordingly, a framework plan for development of the Allegheny River Basin should coordinate the Federal civil works program, Pennsylvania and New York State designs */ for water resources plans, local development district and regional water resources planning board programs, and other private interest programs.

The Ohio River Basin Comprehensive Survey, the Susquehanna River Basin Study, the Genessee River Basin Study, and others will identify additional water-related needs and there must be coordinated planning for attainment of Regional and National objectives of these studies to complement the framework plan.

Plan for Allegheny River Basin

The plan for development of water resources in the Allegheny River Basin portion of Appalachia, for growth and other purposes, would provide the following:

Projects in operation or expected to be in place by 1980:

Corps of Engineers **/

Allegheny River Reservoir
Tionesta Reservoir

*/ Main Report Part IV, N.Y. Water Supplement and Ltr. from Commonwealth of Pennsylvania, 13 May 1969.

**/ See Table 11-4, Chapter 11, Part II.

Union City Reservoir
Woodcock Creek Reservoir
Muddy Creek Reservoir
East Branch Clarion River Reservoir
Mahoning Creek Reservoir
Crooked Creek Reservoir
Conemaugh River Reservoir
Loyalhanna Creek Reservoir

USDA Upstream Watershed Projects */

Conewango Creek
Ischua Creek
Mill Creek
Oil Creek
Sandy Creek

Projects for Authorization by 1980:

Corps of Engineers

St. Petersburg Reservoir, Clarion River, Pennsylvania **/

For Continued Planning:

USDA Watershed Projects ***/

Chautauqua Lake/Chadakoin River
Great Valley Creek ****/
Little Valley Creek ****/
Upper Allegheny River
Potato Creek
Oswago Creek
Brokenstraw Creek ****/
Tionesta Creek
Upper French Creek ****/
Sandy Lick Creek
Mahoning Creek
LeBoeuf Creek
Sugar Creek
West Branch Clarion River
Blacklick Creek ****/
Upper Loyalhanna Creek
Upper Stony Creek ****/

*/ See Table 11-7, Chapter 11, Part II for pertinent data.

**/ Chapter 11, Part III - Project Report, St. Petersburg Reservoir.

***/ See Appendix A for pertinent data.

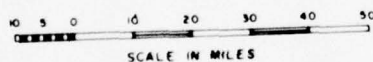
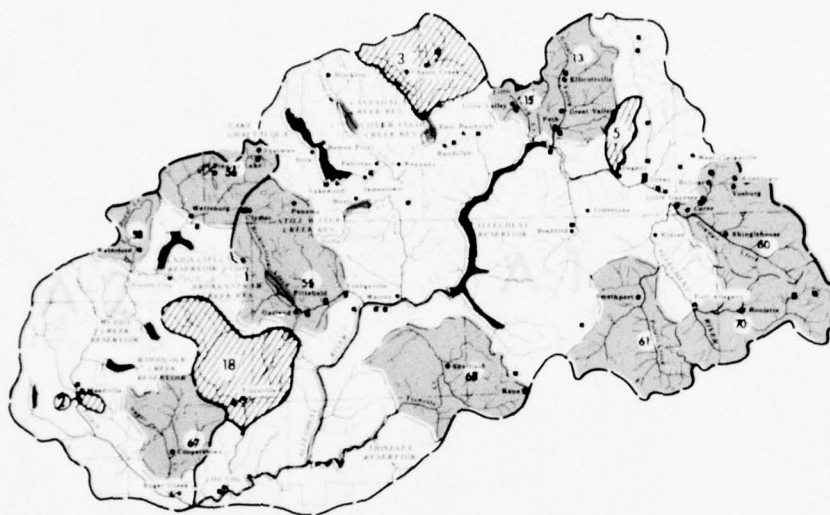
****/ For Early Action.

Future Studies





Three important studies suggested are: (1) investigation of the Allegheny River Basin under a programmed Type II basin study, (2) upper basin development of the Conewango Creek Basin by multiple-purpose projects for flood control, municipal and industrial water supply, recreation and fish and wildlife, irrigation, flow augmentation and pumped-storage power development, and (3) a comprehensive basin-wide pollution abatement study, particularly acid mine drainage^{*/}, for which FWPCA and others are making inventories of pollution sources, intensities, and effects on benthic biology of the Allegheny River drainage system. Underutilized lands in the valleys below potential reservoirs on Conewango Creek, Cassadaga Creek and Stillwater Creek could be made available for industrial, commercial and residential development from Warren and upstream. Additional water supplies, peaking power and recreational facilities needed for economic growth could be supplied, along with flood protection, extending along the middle and lower reaches of Conewango Creek. Middle basin emphasis should be on recreation, with flood plain protection in the Meadville area of French Creek and in the lower reach of Brokenstraw Creek at Youngsville for industrial development. Lower basin requirements include state-park type recreation development of Buffalo Creek, which joins the Allegheny River at Freeport, and possibly developments in the Kiskiminetas River area. There should be consideration of trade-off arrangements by systems analysis of the resources of the entire basin. From these, with pollution abatement and flood plain studies, projects can be formulated for Meadville and the Jamestown-Warren growth centers.

Two maps, one for the Upper Allegheny River Basin, including French Creek, and one for the combined middle river, including the Kiskiminetas River, and lower river, and accompanying schematic diagrams relevant to the growth centers are shown on Figures 12-21 and 12-22.



^{*/} Including already initiated Pennsylvania's Ten Year Mine Drainage Pollution Abatement Program, and other State's on-going pollution abatement programs.





LEGEND

-  APPALACHIAN REGION BOUNDARY
-  WATER SUB-REGION F BOUNDARY
-  UPPER ALLEGHENY RIVER
-  INDUSTRIAL SITE

EXPECTED TO EXIST BY 1980:

-  MAJOR RESERVOIR
-  UPSTREAM WATERSHED F

PLANNING ALTERNATIVES

-  MAJOR RESERVOIR
-  UPSTREAM WATERSHED F

UPSTREAM WATERSHED PROJECT IDENTIFICATION

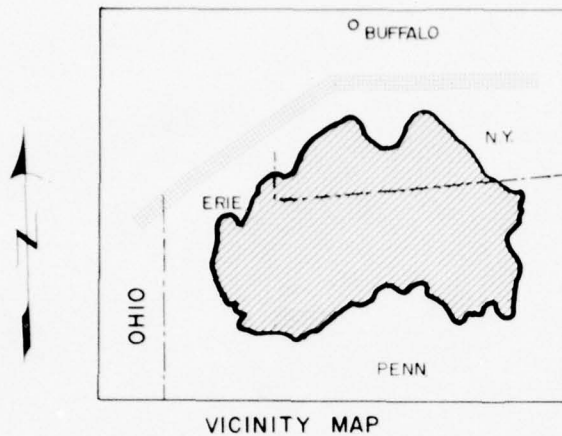
EXPECTED TO EXIST BY 1980

- 2 Mill Run
- 3 Conewango Creek
- 5 Ischua Creek
- 18 Oil Creek

ALTERNATIVE AVAILABLE FOR PLANNING

- 13 Great Valley Creek
- 15 Little Valley Creek
- 55 Brokenstraw Creek
- 56 Upper French
- 58 LeBoeuf Creek
- 60 Oswayo Creek
- 61 Potato Creek
- 67 Sugar Creek
- 68 Tionesta Creek
- 70 Upper Allegheny River

UPPER ALLEGHENY RIVER BASIN
PENNSYLVANIA AND
LOCATION



LEGEND

- APPALACHIAN REGION BOUNDARY
- WATER SUB-REGION F BOUNDARY
- UPPER ALLEGHENY RIVER SUB-BASIN BOUNDARIES
- INDUSTRIAL SITE

EXPECTED TO EXIST BY 1980:

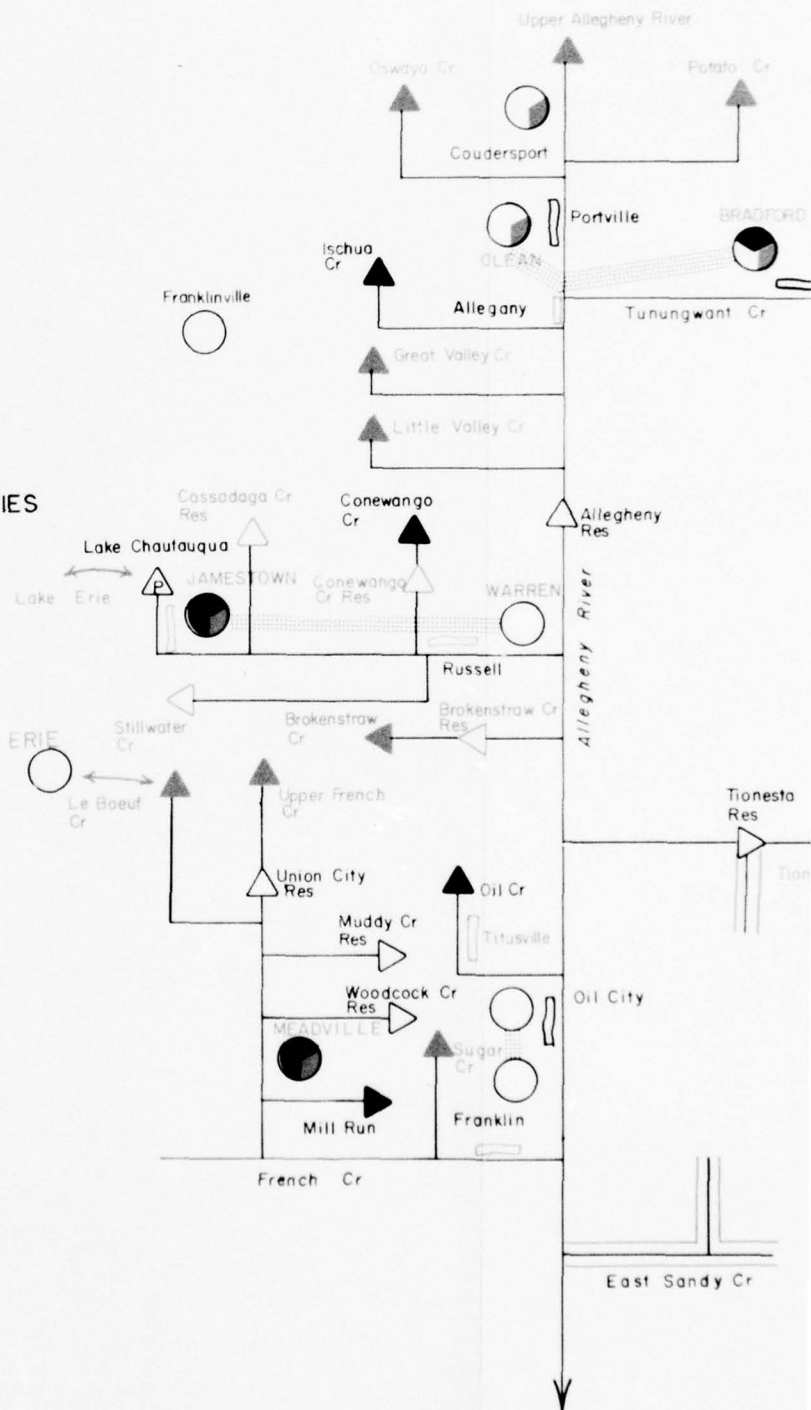
- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT

PLANNING ALTERNATIVES

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT

UPPER ALLEGHENY
RIVER BASIN
PENNSYLVANIA AND NEW YORK




LOCATION MAP



2




LEGEND

NEEDS





-  WATER QUALITY
-  WATER SUPPLY
-  FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

-  MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
-  UPSTREAM WATERSHED PROJECT
-  LPP PROJECT

PLANNING ALTERNATIVES:

-  MAJOR RESERVOIR
-  UPSTREAM WATERSHED PROJECT
-  TRANS-BASIN DIVERSION
-  LOCAL PROTECTION PROJECT

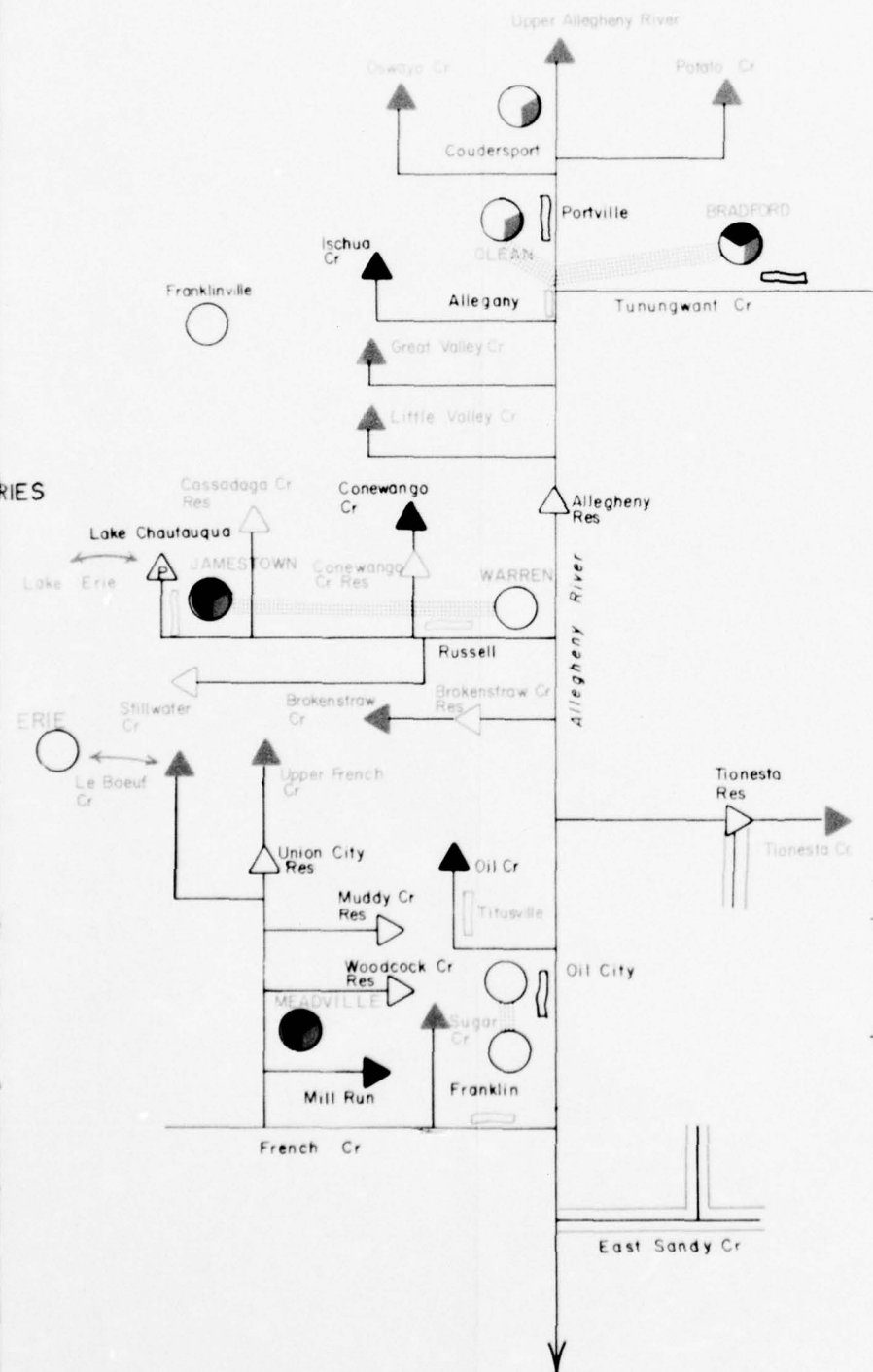
OTHER

TOWN NAME PRIMARY GROWTH CENTER

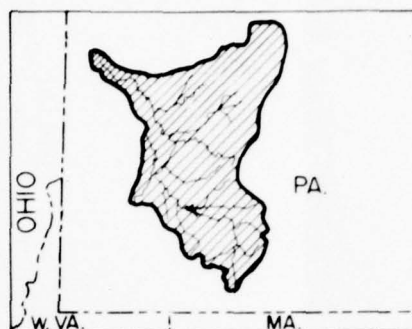
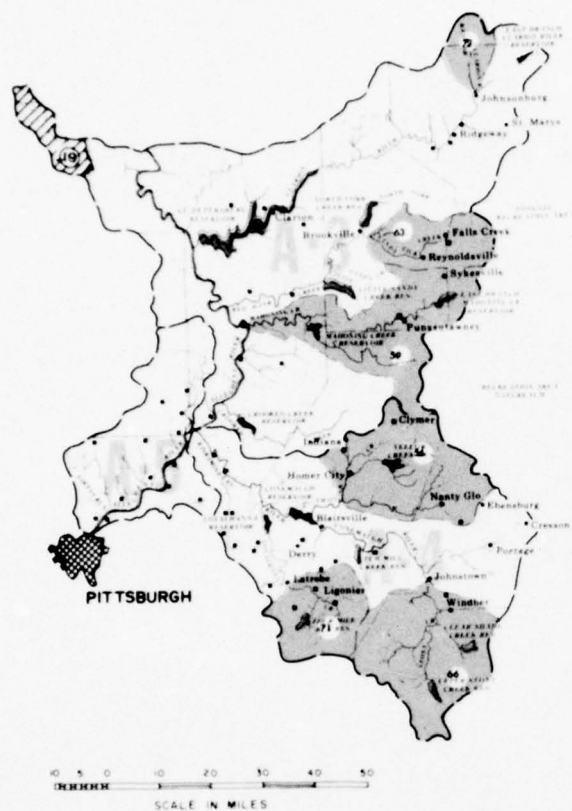
Town Name SECONDARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

CONTINUOUSLY



UPPER ALLEGHENY
RIVER BASIN
PENNSYLVANIA AND NEW YORK
SCHEMATIC OF WATER NEEDS
AND
ALTERNATIVE SOLUTIONS



LEGEND

--- AREA BOUNDARY

■ INDUSTRIAL SITES

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIR

19 UPSTREAM WATERSHED PROJECT

PLANNING ALTERNATIVES

66 UPSTREAM WATERSHED PROJECT

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

19 Sandy Creek

PLANNING ALTERNATIVES

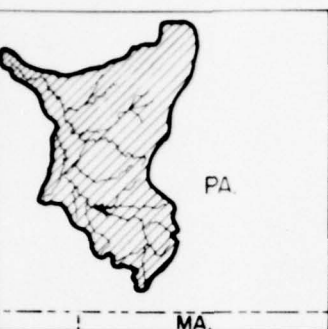
54 Blacklick Creek

59. Mahoning Creek

LOWER ALLEGHENY
RIVER BASIN
PENNSYLVANIA

PENNsylvania

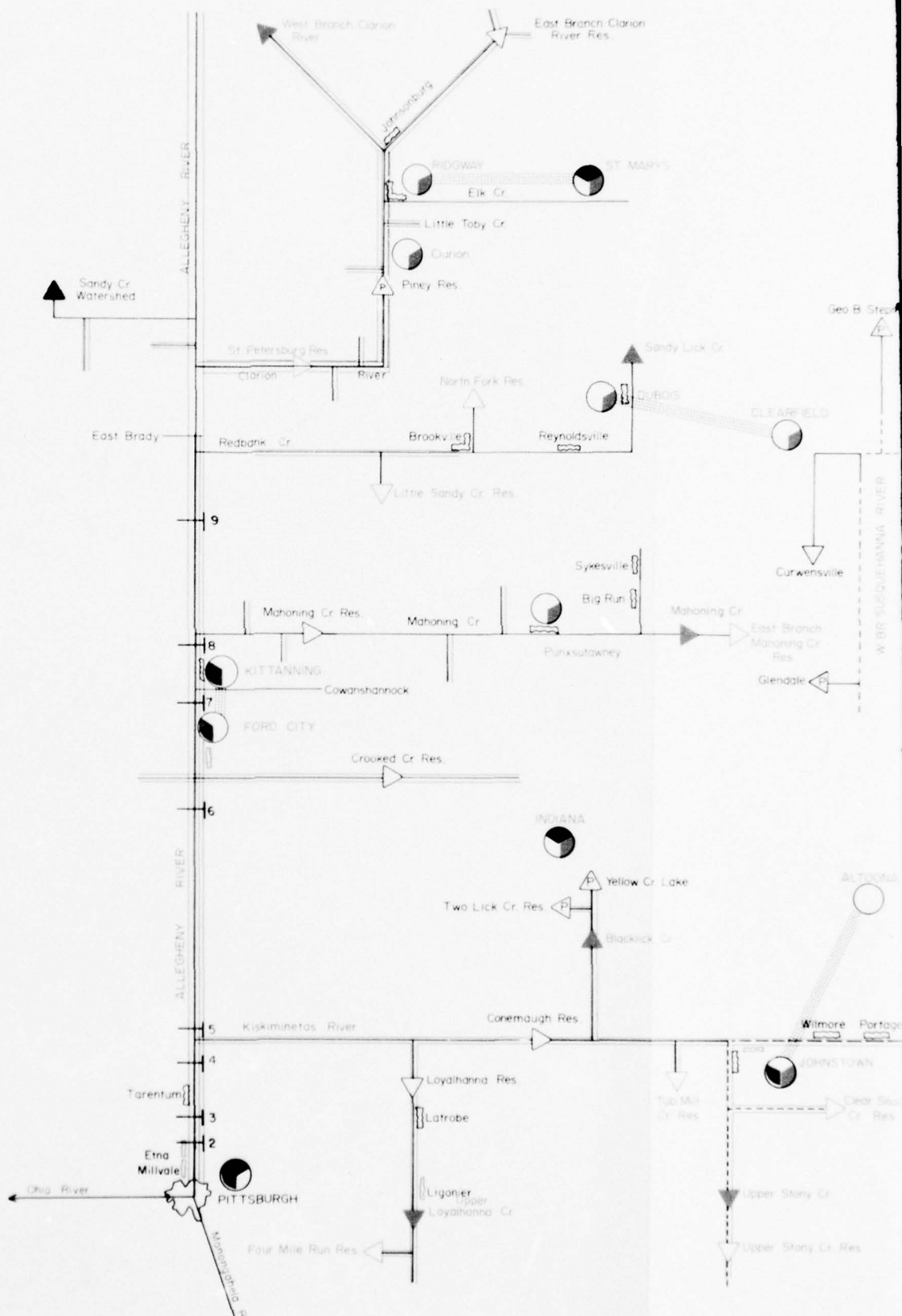
LOCATION MAP



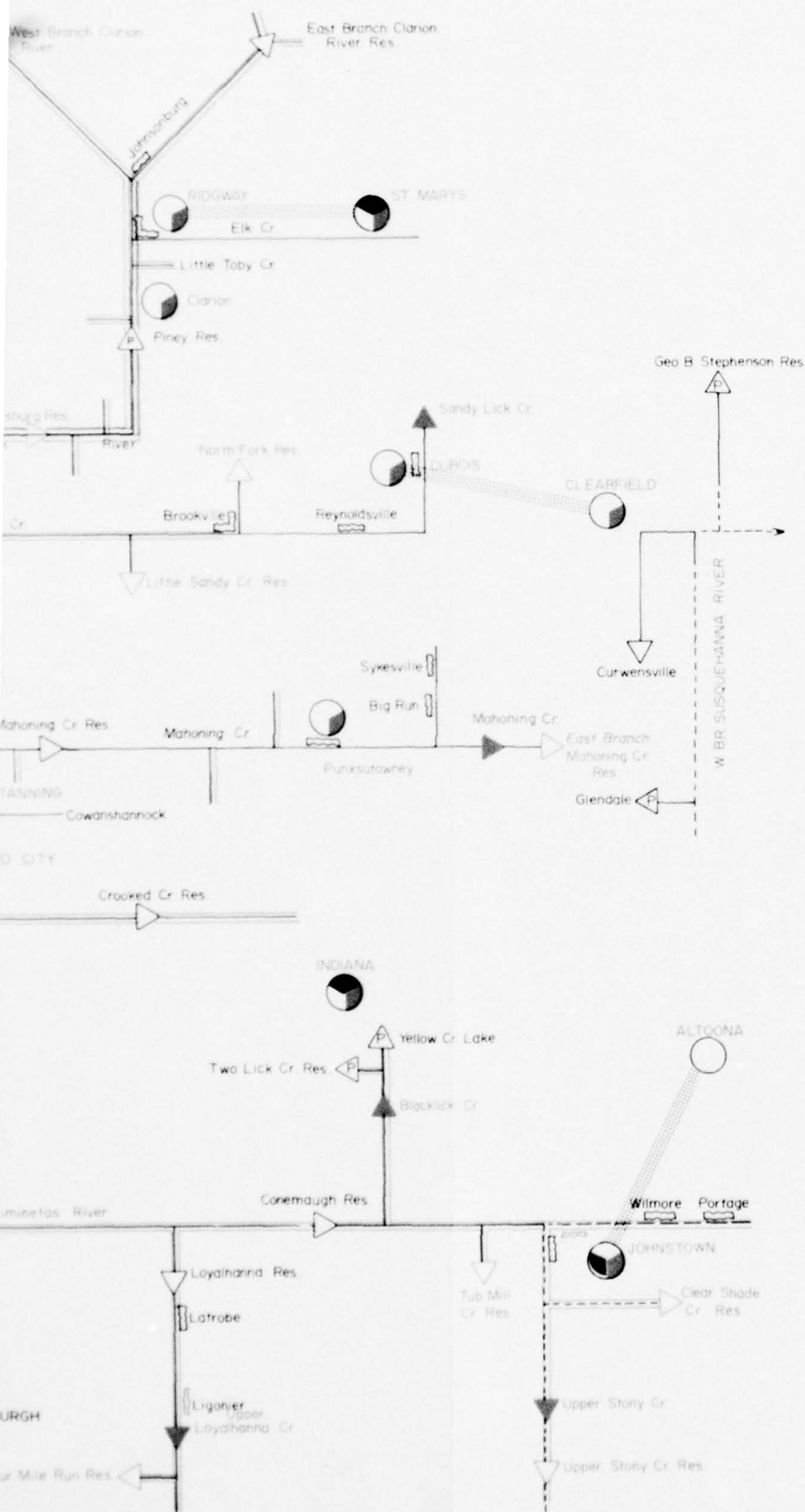
VICINITY MAP

LEGEND

PA BOUNDARY
 INDUSTRIAL SITES
 TO EXIST BY 1980
 FOR RESERVOIR
 STREAM WATERSHED PROJECT
 ALTERNATIVES
 STREAM WATERSHED PROJECT
 FOR RESERVOIR



LOWER ALLEGHENY
 RIVER BASIN
 PENNSYLVANIA
 LOCATION MAP



LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980

- MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
- UPSTREAM WATERSHED PROJECT
- LPP PROJECTS

PLANNING ALTERNATIVES

- MAJOR RESERVOIR: P INDICATES NON-FEDERAL OWNER
- UPSTREAM WATERSHED PROJECT
- LPP PROJECTS

OTHER

- TOWN NAME: PRIMARY GROWTH CENTER
- TOWN NAME: SECONDARY GROWTH CENTER
- SCENIC
- STREAM AFFECTED BY POLLUTION
- CONTINUOUSLY
- INTERMITTENTLY

LOWER ALLEGHENY
RIVER BASIN
PENNSYLVANIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

11-12-129

FIGURE 12-22

3

Monongahela River Basin */

Subdivision M-1

Entire Tygart River Basin.

Growth Centers: Primary: Elkins and Buckhannon-Philippi.
Secondary: Grafton.

Elkins. (See Figure 12-23.) Currently this growth center experiences annual flood damages of approximately \$3,000 residual damage to existing developments within the protected area of the local protection project. Future land use plans indicate additional protection of flood plains outside of the protected area is needed. Water supply needs for year 2020 are estimated at 15 mgd and stream flow of 15 cfs will be required to assimilate residual waste loads after secondary treatment.

The river valley above Elkins offers possibilities for extensive developments. Few areas in the Monongahela River Basin compare with the resource and potential developmental advantages of this 13,000 acre, which can be easily protected, flood plain. This wide, flat valley, about 20 miles long and about a mile wide would probably support a new town complex and an extensive array of light industries in West Virginia.

A reservoir at the upper end of this valley could offer flood protection with water supply and quality flows. Additional impoundments on the steep tributary sides of the valley could supplement the larger reservoir for flood control and provide additional water supply. These impoundments would also satisfy all of the needs at Elkins. Detailed future study is suggested of this entire area for future flood control and water supply requirements. In addition, with Appalachian Corridor H connecting to the east coast, a high level of recreation demand could be satisfied in this area.

Buckhannon-Philippi. (See Figure 12-23.) Current urban annual flood damages in this growth center amount to about 9,000 dollars. These are residual damages from existing local protection project at Buckhannon, and damage to developed flood plain areas of Philippi. Projected water supply requirements amount to about 30 mgd and stream flows for residual waste assimilation require 14 cfs in the Buckhannon River, at Buckhannon, and 15 cfs in the Tygart River, at Philippi.

Potential reservoirs on Upper Tygart River, Middle Fork River and Buckhannon River and upstream watershed projects for Upper Buckhannon River and French Creek offer water supply and flood control satisfactions. Future studies are needed to time phase these potentials.

*/ See Figure 12-31 for additional features discussed by subdivisions of basin.

Upper Tygart Valley R. Lake
(Potential)

F.C. - 45,000 ac.ft.

Dependable Flow

Gross - 110 cfs

Net - 108 cfs

ELKINS

Est. of Needs

Existing Flood Damage - \$3,000

W.S. - 15 mgd

W.Q. - 14 cfs

Middle Fork R. Lake
(Potential)

F.C. - 105,000 ac.ft.

Dependable Flow

Gross - 290 cfs

Net - 289 cfs

Upper Buckhannon R. W.S.
(Potential)

10 reservoirs (1 mp)

F.C. - 12,485 ac.ft.

French Cr. W.S.
(Potential)

4 reservoirs (1 mp)

F.C. - 3,310 ac.ft.

BUCKHANNON, W. VA.

Est. of Needs

Current Flood Damage - \$5,000

W.S. - 15 mgd

W.Q. - 14 cfs

Buckhannon R. Lake
(Potential)

F.C. - 106,000 ac.ft.

Dependable Flow

Gross - 232 cfs

Net - 230 cfs

PHILIPPI, W. VA.

Est. of Needs

Current Flood Damages - \$4,000

W.S. - 14 mgd

W.Q. - 15 cfs

Totals from Tygart R. Basin

above Philippi, W. Va.

F.C. (Potential) - 260,025 ac.ft.

Dependable Flow

Gross (Potential) - 636 cfs

Net (Potential) - 627 cfs

UPPER TYGART RIVER BASIN

II-12-133

Figure 12-23

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Grafton. (See Figure 12-24.) This specific growth center, located just below Tygart River Reservoir, has relatively minor water needs. Extremely limited available land areas preclude extensive developmental possibilities. The State of West Virginia desires longer duration of summer recreation pool, without excessive drawdown, at Tygart Lake. Since this lake is operated for low-flow augmentation in the Monongahela River, drawdown begins well before the end of the recreation season. Methods for maintaining the summer pool require investigation. Construction of sub-impoundments immediately upstream of the Lake on Teter and/or Laurel Creek tributaries is one possibility. Storage in these impoundments could be released during periods of low flow, and the summer level of Tygart Lake maintained accordingly. An alternative, perhaps more desirable because of Tygart conservation pool topographical limitations, would be intensive recreation development at the sub-impoundments in lieu of increased development at Tygart.

Subdivision M-2

Entire West Fork River Basin. (See Figures 12-25 and 12-26.)

Growth Centers: Primary: Clarksburg-Fairmont.
Secondary: Weston.
Discussions below extend from the headwaters to the mouth.

Weston. This growth center, in the headwaters of the West Fork River, will have few water related problems after the completion of Stonewall Jackson Lake and Polk Creek Upstream Watershed Projects. Flooding will be eliminated and there will be no apparent water supply problems.

Clarksburg-Fairmont. Clarksburg is one of the largest cities in Northcentral West Virginia. Flood damages, although reduced with the completion of Stonewall Jackson Lake, will still cause considerable problems because of the size and location of a large number of tributary streams below the dam. Six other sizable communities, along the river between Clarksburg and Fairmont, have also been subjected to exceptionally high flooding in recent years. Residual annual flood damages in this area, after Stonewall Jackson Reservoir is operating, will be 193,000 dollars.

The City of Clarksburg has frequently suffered from limited water supply. Stonewall Jackson Reservoir is expected to fill the needs of Clarksburg itself, however, expansion of the whole area would lead to future water shortages. Future requirements are estimated at 30 mgd for water supply and 100 cfs to assimilate residual waste loads. An assured flow of 55 cfs from Stonewall Jackson leaves a 45 cfs deficit.

Studies of the area flood problem are currently underway by the Corps of Engineers. It is expected that some solution recommendations

Totals from Tygart River Basin
above Philippi, W. Va.

F.C. (Potential) - 260,025 ac.ft.
Dependable Flow
Gross (Potential) - 636 cfs
Gross (Existing) - 9 cfs
Net (Potential) - 627 cfs

Laurel Cr. Lake
(Potential)

F.C. - 17,400 ac.ft.
Dependable Flow
Gross - 200 cfs
Net - 200 cfs

Teter Cr. Lake
(Potential)

F.C. - 50,200 ac.ft.
Dependable Flow
Gross - 104 cfs
Net - 104 cfs

Tygart Lake
(Existing)

F.C. - 278,000 ac.ft.
Dependable Flow
Gross - 170 cfs
Net - 150 cfs

Three Fork W.S.
(Potential)

5 reservoirs - (1 mp)
F.C. - 11,825 ac.ft.

Sandy Cr. W.S.
(Potential)

4 reservoirs - (1 mp)
F.C. - 3,160 ac.ft.

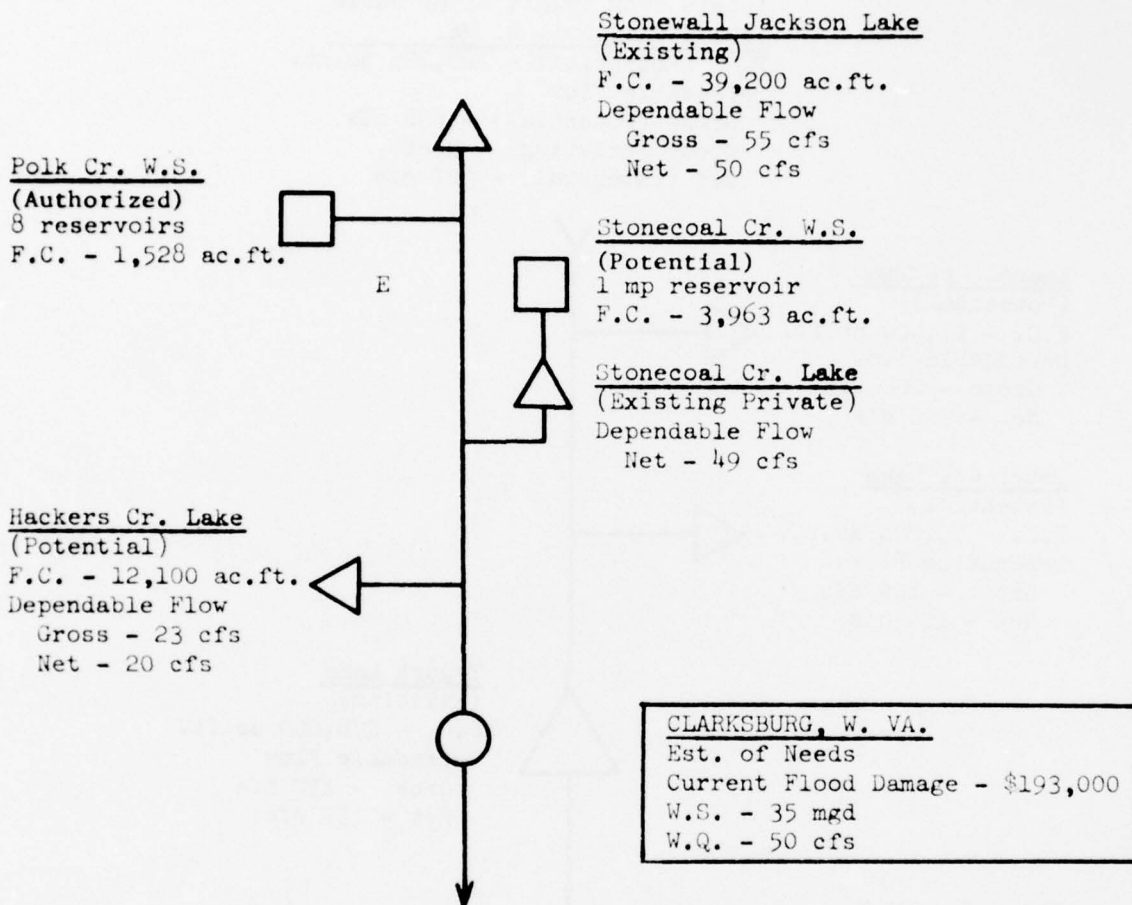
Totals Available from Tygart
River Basin

F.C. (Existing) - 278,000 ac.ft.
F.C. (Potential) - 620,610 ac.ft.
Dependable Flow
Gross (Existing) - 170 cfs
Gross (Potential) - 950 cfs
Net (Existing) - 150 cfs
Net (Potential) - 930 cfs

LOWER TYGART RIVER BASIN

Figure 12-24

II-12-135



Totals from West Fork
Basin above Clarksburg
F.C. (Existing) - 40,728 ac.ft.
F.C. (Potential) - 56,791 ac.ft.
Dependable Flow
Gross (Existing) - 104 cfs
Gross (Potential) - 124 cfs
Net (Existing) - 99 cfs
Net (Potential) - 119 cfs

UPPER WEST FORK RIVER BASIN

Figure 12-25

Totals from West Fork River Basin
above Clarksburg, W. Va.

F.C. (Existing) - 40,728 ac.ft.

F.C. (Potential) - 56,791 ac.ft.

Dependable Flow

Gross (Existing) - 104 cfs

Gross (Potential) - 124 cfs

Net (Existing) - 99 cfs

Net (Potential) - 119 cfs

Elk Cr. W.S.

(Potential)

11 reservoirs - (1 mp)

F.C. - 14,820 ac.ft.

Elk Cr. Lake

(Potential)

F.C. - 34,600 ac.ft.

Dependable Flow

Gross - 58 cfs

Net - 55 cfs

Simpson Cr. W.S.

(Potential)

11 reservoirs - (3 mp)

F.C. - 8,740 ac.ft.

Limestone Run, W.S.

(Potential)

1 mp reservoir

F.C. - 235 ac.ft.

Salem Fork-Tenmile Cr. W.S.

(Existing)

8 reservoirs

F.C. - 496 ac.ft.

Ten Mile Cr. Lake

(Potential)

F.C. - 35,200 ac.ft.

Dependable Flow

Gross - 72 cfs

Net - 70 cfs

Totals from West Fork Basin

F.C. (Existing) - 41,224 ac.ft.

F.C. (Potential) - 150,882

Dependable Flow

Gross (Existing) - 111 cfs

Gross (Potential) - 256 cfs

Net (Existing) - 99 cfs

Net (Potential) - 244 cfs

LOWER WEST FORK RIVER BASIN

will be made prior to 1980. Potential upstream watershed projects on Stonecoal Creek, Elk Creek, Limestone Run, and Simpson Creek and reservoirs on Hackers Creek, Elk Creek, and Ten Mile Creek should receive consideration to resolve the water supply, quality, and flood problems.

Subdivision M-4

Youghiogheny River Basin. (See Figure 12-27.)

Growth Centers: Primary: Connellsville-Somerset.
Secondary: Oakland, Md., and a portion of the Greater Pittsburgh Regional Growth Center. These are discussed in downstream order.

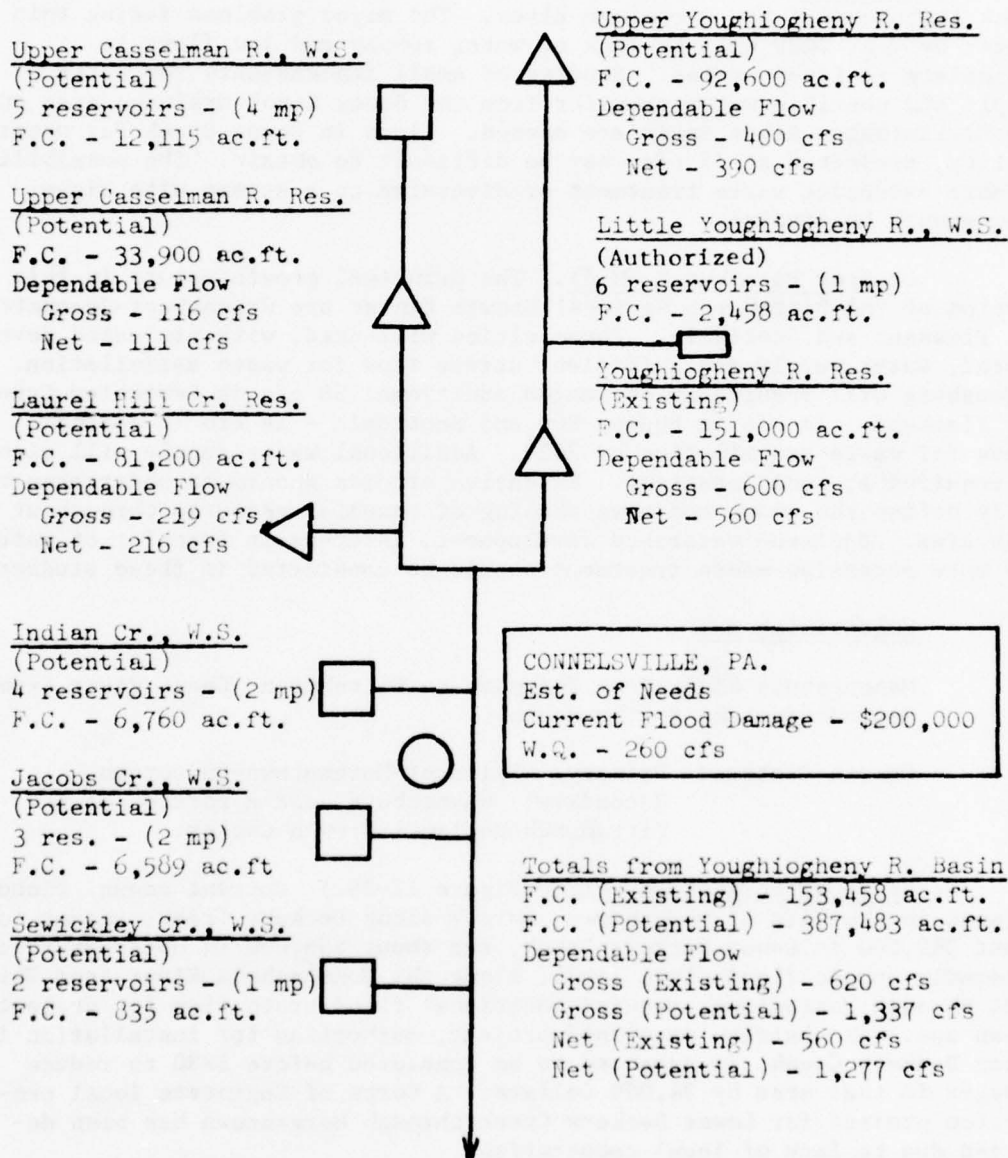
Oakland. This secondary growth center is not expected to have any major water problems after completion of the Little Youghiogheny River upstream watershed project. A potential reservoir site on the Upper Youghiogheny River would also be available to provide for any unforeseen problems. This reservoir would permit low flow releases to enhance recreation on the Youghiogheny River below Oakland. This reach of the river, extending to Youghiogheny Reservoir, is now being considered for addition to the Wild and Scenic Rivers System. Assured flow in the river would enhance this aspect. Assured flow would augment existing Youghiogheny Reservoir, permitting higher summer pool level throughout the recreation season, while maintaining flow releases to the downstream reach. This area, from the dam to Connellsville, is also under consideration for addition to the Wild and Scenic River System.

Connellsville. This city is part of the Uniontown-Connellsville primary growth center which straddles the divide between the Youghiogheny and Monongahela River drainages. This portion of the growth center extends through the area contiguous to the Youghiogheny Valley to Confluence, and then up the Casselman River to Grantsville, Md., including Rockwood, Garrett, and Meyersdale, Pa.

Current annual flood damage in Connellsville amount to \$450,000, from the Casselman River and Laurel Hill Creek uncontrolled flows. Confluence, Meyersdale, Rockwood, and Garrett also experience flooding in varying degrees. Water supply is expected to present some problems, especially in the upstream communities. Water quality improvement is currently needed because of acid mine drainage from the Casselman River.

Potential reservoir sites, on the Upper Casselman River and Laurel Hill Creek, and a potential upstream watershed project in the Upper Casselman River Valley, could alleviate much of the flood problem and provide reserve water supply. An acid mine drainage abatement program is needed in the Casselman Valley to improve water quality.

The reach of the Youghiogheny from the dam to Connellsville, is under consideration for addition to the National Wild and Scenic Rivers System. The reach contains the Ohiopyle Pennsylvania Recreation Area,



YOUGHIOGHENY RIVER BASIN

Figure 12- 27

an extensive state development and would be enhanced by water quality and flow improvements.

Somerset. This primary growth center is located on the Coxes Creek tributary of the Casselman River. The major problems facing this center by year 2020 will be lack of water supply and low flows to assimilate residual wastes. Studies of small impoundments for water supply and possible water transfer from the Stony Creek drainage area on the Kiskiminetas River Basin are needed. Flows in Coxes Creek for water quality, projected at 75 cfs, may be difficult to obtain. The possibility of more extensive waste treatment or diversion to a stream with higher flow should be studied.

Greater Pittsburgh (M-4). The principal growth points in this portion of the Pittsburgh Regional Growth Center are Greensburg-Jeannette, Mt. Pleasant and Scottdale. These cities will need, with projected development, water supply and sufficient stream flow for waste assimilation. Greensburg will require an estimated additional 68 cfs in Sewickley Creek, Mt. Pleasant - 11 cfs in Shupes Run and Scottdale - 14 cfs in Jacobs Creek for waste assimilation by 2020. Additional water supply will also be required at most locations. Extensive studies should be undertaken to fully define the scope and time-phasing of remedial measures throughout this area. Upstream watershed development, inter-basin transfer of water, and more extensive waste treatment should be considered in these studies.

Subdivision M-5

Monongahela River from Fairmont to Pittsburgh; Cheat River from Rowlesburg Lake to the mouth.

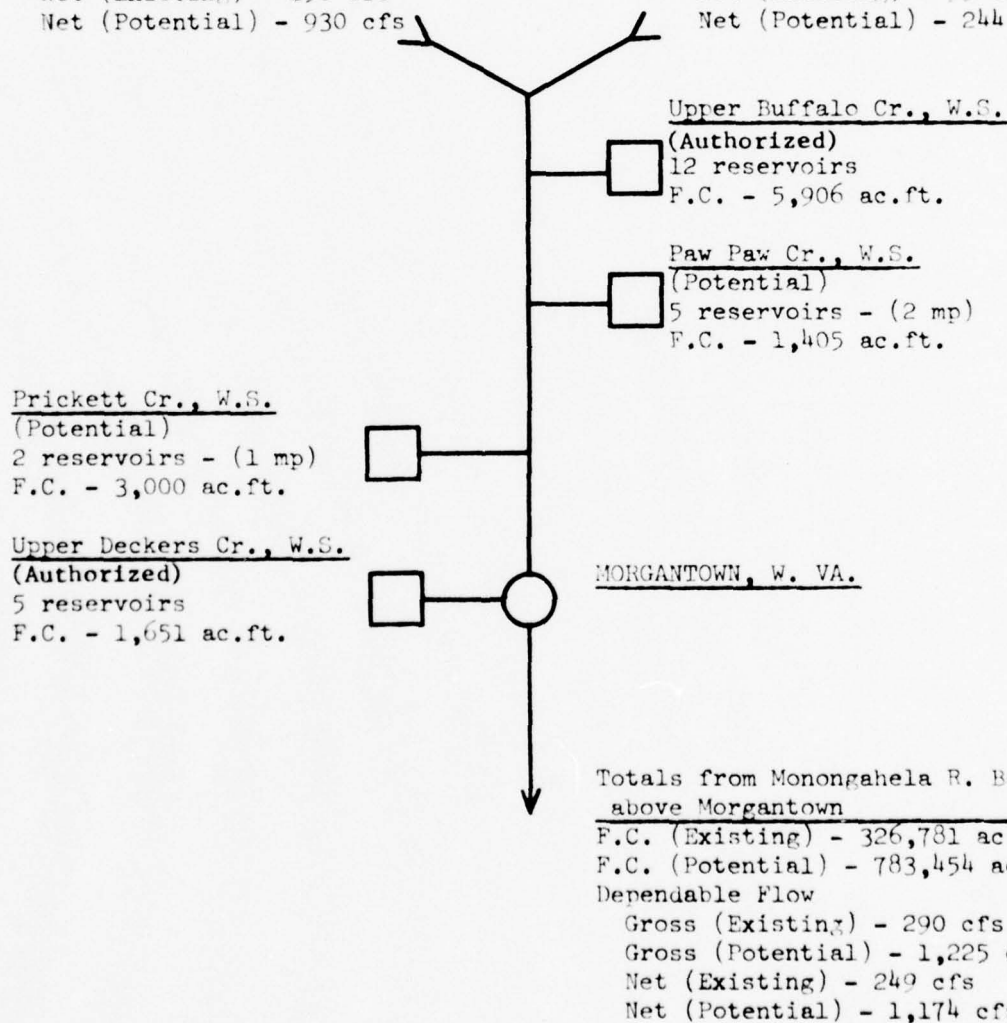
Growth Centers: Primary: Fairmont-Morgantown-Uniontown.
Secondary: Waynesburg, and a portion of the Pittsburgh Regional Growth Center.

Fairmont-Morgantown. (See Figure 12-28.) Current annual flood damages in the City of Morgantown, mainly along Deckers Creek, amount to about \$40,000 in Lower Deckers Creek, and about \$36,000 in upstream reaches. Presently unused flood plain lands, along the Monongahela River from Fairmont through Morgantown, require additional flood protection for projected urban use. An upstream watershed project, authorized for installation in Upper Deckers Creek, is expected to be completed before 1980 to reduce damages in that area by 34,000 dollars. A Corps of Engineers local protection project for Lower Deckers Creek through Morgantown has been deferred due to lack of local cooperation.

Uniontown. This city, the western terminus of the Uniontown-Connellsville growth center, is located along Redstone Creek. Current annual flood damages amount to about \$112,000 throughout the urban area.

Totals from Tygart R. Basin
 F.C. (Existing) - 278,000 ac.ft.
 F.C. (Potential) - 620,610 ac.ft.
 Dependable Flow
 Gross (Existing) - 170 cfs
 Gross (Potential) - 950 cfs
 Net (Existing) - 150 cfs
 Net (Potential) - 930 cfs

Totals from West Fork R. Basin
 F.C. (Existing) - 41,224 ac.ft.
 F.C. (Potential) - 150,882 ac.ft.
 Dependable Flow
 Gross (Existing) - 111 cfs
 Gross (Potential) - 256 cfs
 Net (Existing) - 99 cfs
 Net (Potential) - 244 cfs



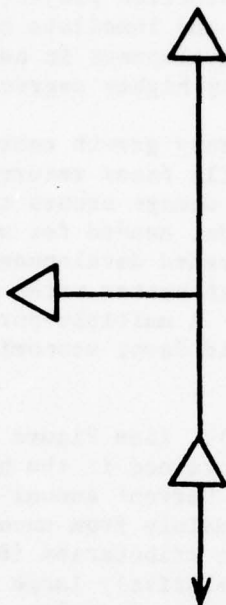
MONONGAHELA RIVER BASIN

Figure 12-28

Rowlesburg Lake
 (Existing)
 F.C. - 299,600 ac.ft.
 Dependable Flow
 Gross - 1,600 cfs
 Net - 1,580 cfs

Big Sandy Cr. Res.
 (Potential)
 F.C. - 129,000 ac.ft.
 Dependable Flow
 Gross - 289 cfs
 Net - 287 cfs

CHEAT LAKE



Totals from Cheat River Basin
 F.C. (Existing) - 299,600 ac.ft.
 F.C. (Potential) - 428,600 ac.ft.
 Dependable Flow
 Gross (Existing) - 1,680
 Gross (Potential) - 1,967
 Net (Existing) - 1,580
 Net (Potential) - 1,867

CHEAT RIVER BASIN

Figure 12- 29

II-12-143

There is no water supply problem. However, to assimilate residual wastes, Redstone Creek flow is projected to require 20 cfs by 2020.

An authorized local flood protection project, formulated by the Corps of Engineers, requires rescoping and immediate consideration^{*/} for implementation. Upstream watershed development is needed for waste assimilation flows to be supplemented by higher degree of waste treatments.

Waynesburg. This secondary growth center, located on South Branch of Ten Mile Creek, currently faces recurring water supply problems. A minimal amount of annual flood damage occurs to existing developments. Currently unused flood plain lands, needed for urban expansion, will require protection. Upstream watershed developments and downstream reservoirs should be studied for growth center water supply, and for alleviation of general flood problems. A multiple-purpose reservoir on the North Fork of Ten Mile Creek would favor economic development and recreation for the area.

Greater Pittsburgh (M-5). (See Figure 12-30.) This portion of the regional growth center is contained in the highly industrialized Lower Monongahela River Valley. Current annual flood damages approximate 300,000 dollars.^{**/} These stem mainly from uncontrolled flows of the larger upstream Monongahela River tributaries (Big Sandy Creek, Dunkard Creek, and Ten Mile Creek) and relatively large upstream Youghiogheny River tributaries (Laurel Hill Creek, Casselman River and Sewickley, Indian, and Jacobs Creeks). About 1,000 acres of unused flood plain lands, projected for urban use, require protection. Water quality needs are severe in this portion of the Monongahela River Basin. The Federal Water Pollution Control Administration has estimated that, by year 2020, peak summer river flow of 4,500 cfs will be required at Braddock, Pa. After Rowlesburg Lake is placed in operation, flows at this point will be about 3,100 cfs leaving a deficiency of 1,400 cfs.

A watershed protection project in Jacobs Creek, expected to be operational before 1980, and potential upstream watershed projects for Sewickley and Indian Creeks will reduce flood flows from these creeks. Potential reservoir projects on Big Sandy, Dunkard, and Laurel Hill Creeks would also effectively reduce Monongahela River flood heights through the growth center and downstream and should receive survey coverage soon. These additions to the existing flood control system could reduce annual damage by more than \$200,000.

Other Considerations

Water supply, quality, and recreation projects in the Monongahela River headwater areas, discussed above, provide a unique situation for

^{*/} Commonwealth of Pennsylvania

^{**/} After Rowlesburg Lake is in operation.

Totals from Cheat R. Basin

F.C. (Existing) - 299,600 ac.ft.
F.C. (Potential) - 428,600 ac.ft.

Dependable Flow

Gross (Existing) - 1,680 cfs
Gross (Potential) - 1,967 cfs
Net (Existing) - 1,580 cfs
Net (Potential) - 1,867 cfs

Totals from Monongahela R. Basin
above Morgantown, W.Va.

F.C. (Existing) - 326,781 ac.ft.
F.C. (Potential) - 783,454 ac.ft.

Dependable Flow

Gross (Existing) - 290 cfs
Gross (Potential) - 1,225 cfs
Net (Existing) - 249 cfs
Net (Potential) - 1,174 cfs

Dunlap Cr., W.S.

(Authorized)
4 reservoirs - (1 mp)
F.C. - 1,227 ac.ft.

Dunkard Cr. Res.
(Potential)

F.C. - 60,900 ac.ft.
Dependable Flow
Gross - 55 cfs
Net - 54 cfs

Totals from Youghiogheny R. Basin

F.C. (Existing) - 153,458 ac.ft.
F.C. (Potential) - 387,483 ac.ft.

Dependable Flow

Gross (Existing) - 620 cfs
Gross (Potential) - 1,337 cfs
Net (Existing) - 560 cfs
Net (Potential) - 1,277 cfs

Turtle Cr., W.S.

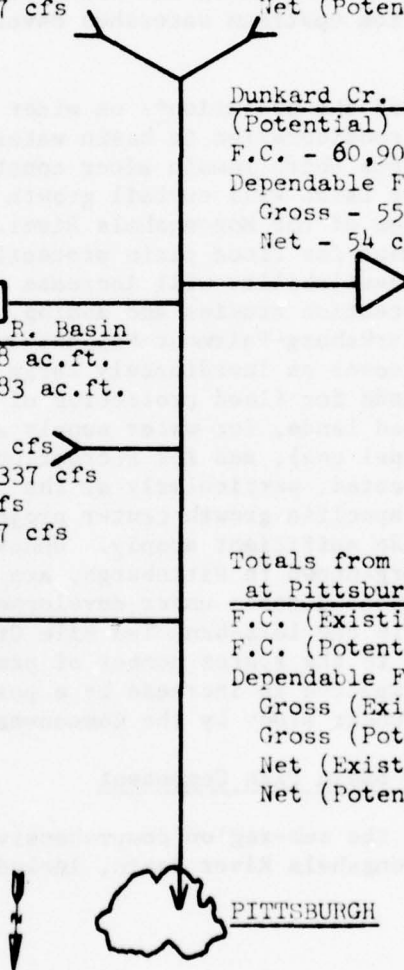
(Potential)
4 reservoirs
F.C. - 2,205 ac.ft.

Totals from Monongahela R. Basin
at Pittsburgh

F.C. (Existing) - 781,066 ac.ft.
F.C. (Potential) - 1,663,869 ac.ft.

Dependable Flow

Gross (Existing) - 2,739 cfs
Gross (Potential) - 4,722 cfs
Net (Existing) - 2,389 cfs
Net (Potential) - 4,372 cfs



MONONGAHELA RIVER BASIN

Figure 12-30

hydropower and water supply at the coincidental headwater areas of the Tygart River, Kanawha River, Little Kanawha River, and smaller direct drainage of the Ohio River. Potential for storage tradeoff lies among existing Sutton and Burnsville Reservoirs (by 1980), Stonewall Jackson Reservoir; authorized Leading Creek Reservoir, Birch Reservoir, and West Fork (Little Kanawha River) Reservoir; potential Hughes River and Upper Buckhannon River Middle Fork and Upper Tygart River Reservoirs; and existing Tygart River Reservoir in combination with potential Teter Creek and Laurel Creek Reservoirs. Private power company reservoirs for cooling water could be another alternative source for all these purposes. Future water supply problems of Clarksburg and Bridgeport, W. Va., may be met by basin transfers, or from upstream watershed developments by SCS under the PL 566 Program.

The effects of the pollution*/ on wider area economic growth becomes an important consideration in basin water resource plan evolution. Flooding problems which remain after construction of Stonewall Jackson and Rowlesburg Lakes will curtail growth along the West Fork River and the main stem of the Monongahela River. Economic development will increase the demand for flood plain protection and the present limited useable land availability will increase the need for flood control, flood plain protection studies and zoning, floodproofing, flood warning, etc. The Clarksburg-Fairmont-Morgantown primary growth center needs outlined above cover an inordinately large area of interest. With expected growth, demands for flood protection of intensively developed and largely undeveloped lands, for water supply and water quality (for industrial and municipal use), and for recreation, may increase significantly more than expected, particularly at the presently rural locations where the diagrammed specific growth center projects and alternatives above would not provide sufficient supply. Undeveloped flood plain along the main stem from Morgantown to Pittsburgh, are likewise expected to generate more than expected needs under developmental pressures. Also, needs of rural areas in the left-bank Ten Mile Creek Basin which are not specifically attached to the sparse number of presently developed growth center areas may be expected to increase by a possible state-park type development which is under study by the Commonwealth of Pennsylvania.

Monongahela River Basin Plan Component

This component of the sub-region comprehensive water resource development plan, in the Monongahela River Basin, includes the following:

*/ For pertinent data see Table 11-4, Chapter 11, Part II.

Projects in operation or expected to be in place by 1980:

Corps of Engineers */

Tygart Lake
Youghiogheny Reservoir
Rowlesburg Lake
Stonewall Jackson Lake

USDA Upstream Watershed Projects **/

Polk Creek
Upper Deckers Creek
Little Youghiogheny River
Salem Fork - Ten Mile Creek
Dunlap Creek
Upper Buffalo Creek

For Continued Planning:

USDA Watershed Projects ***/

Upper Buckhannon River****/ 1/
Elk Creek****/ 1/
Simpson Creek****/ 1/
Three Fork Creek 1/
Stonecoal Creek
Paw Paw Creek
Indian Creek
Sewickley Creek 1/
French Creek
Limestone Run 1/
Sandy Creek
Ten Mile Creek****/
Pickett Creek 1/
Upper Casselman River****/ 1/
Jacobs Creek 1/
Turtle Creek

*/ For pertinent data see Table 11-4, Chapter 11, Part II.

**/ For pertinent data see Table 11-7, Chapter 11, Part II.

***/ See Appendix A for pertinent data.

****/ Joint study of C of E.

1/ For Early Action.

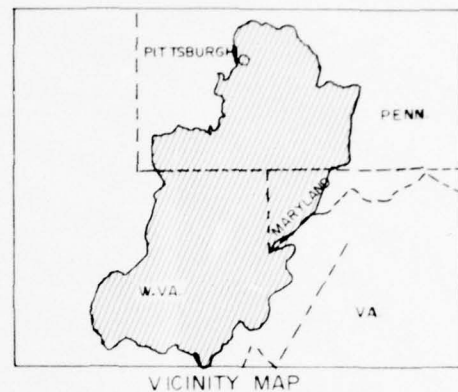
Future Studies

Initiate study of the Monongahela River Basin, coordinated with continuing Youghiogheny River Basin study, to resolve flooding, water supply, water quality, hydroelectric power, recreation and other water problems. This study should: complete definition of needs, especially extent of water pollution; develop comprehensive and flexible water resource management (and tradeoff possibilities) with special emphasis on protection of good quality water supply sources, flood plain zoning and other non-structural controls advantageous to economic development; and indicate systems relationships with Allegheny, Beaver and Upper Ohio River Basin studies.

Certain reservoir and other types of water resources projects in the Monongahela River Basin have been identified for relieving problems constraining the area, or with potentials of local widespread effect, sufficient to merit early concentration of planning efforts. Others that should be studied are: (1) the Upper Tygart River Valley - to provide for needs of the Elkins (and Belington) W. Va., growth center, and to exploit the developmental potential of the intervening river valley located between Elkins and Valley Bend; (2) the Buckhannon and Middle Fork River Valleys - to provide all manner of needs, to widespread urban and rural areas, from potential reservoir sites on these two rivers; (3) the Lower West Fork River Basin - to implement a comprehensive river improvement program to eliminate flood problems, locate additional sources of water supply, improve water quality, and furnish recreational opportunities; and (4) the Middle and Lower Monongahela River Basin - to provide a significant increase in flood control, improve water supply and water quality, and satisfy recreation demands by implementation of tributary reservoirs on Big Sandy Creek, Dunkard Creek; and these to be supplemented by Youghiogheny River Basin projects - to effect multiple purpose uses also on Laurel Hill Creek and Upper Casselman Rivers. Wild and scenic river potentials should be studied in the Youghiogheny River Basin along the main river reach from Confluence, Pennsylvania, to Youghiogheny Reservoir, and for the upper Youghiogheny River upstream to Oakland, Maryland. A comprehensive basin-wide pollution abatement study should be pressed forward relentlessly, particularly acid mine drainage^{*/}, the same as suggested for the Allegheny River Basin.

The Monongahela River Basin Map and accompanying schematic diagram relative to the growth centers is shown on Figure 12-31.

^{*/} Monongahela River Enforcement Conference, etc.



LEGEND

- WATERSHED BOUNDARY EXPECTED TO EXIST BY 1980
- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- PLANNING ALTERNATIVES
- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT

UPSTREAM WATERSHED PROJECT IDENTIFICATION

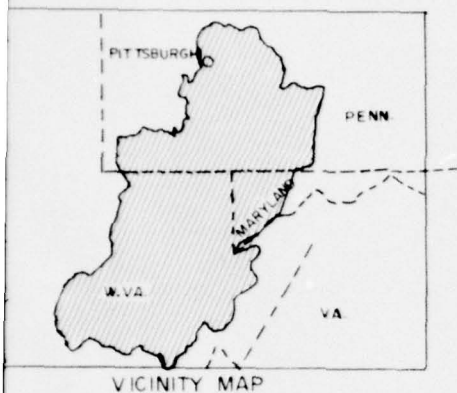
EXPECTED TO EXIST BY 1980

- 1 Little Youghiogheny River
- 4 Salem Fork-Ten Mile Cr
- 7 Dunlap Cr
- 14 Polk Cr
- 18 Upper Deckers Cr
- 69 Upper Buffalo Cr

ALTERNATIVES AVAILABLE FOR PLANNING

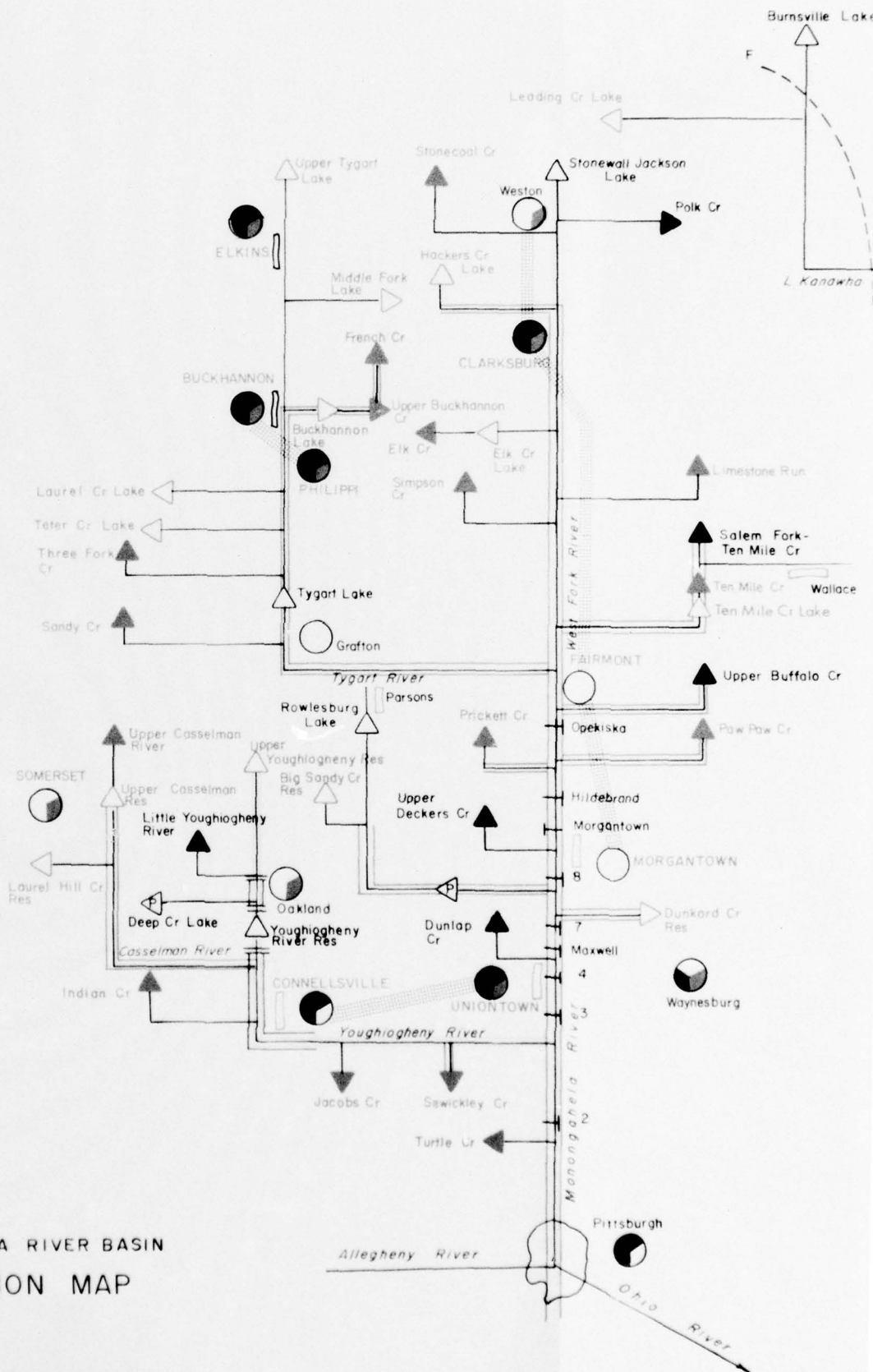
- 2 Upper Casselman River
- 33 Jacob Cr
- 57 Indian Cr
- 63 Stonecoal Cr
- 64 Ten Mile Cr
- 69 Turtle Cr
- 79 Elk Cr
- 80 French Cr
- 82 Limestone Run
- 84 Paw Paw Cr
- 85 Prickett Cr
- 86 Sandy Cr
- 87 Simpson Cr
- 88 Three Fork
- 93 Upper Buckhannon River
- 94 Ten Mile Cr

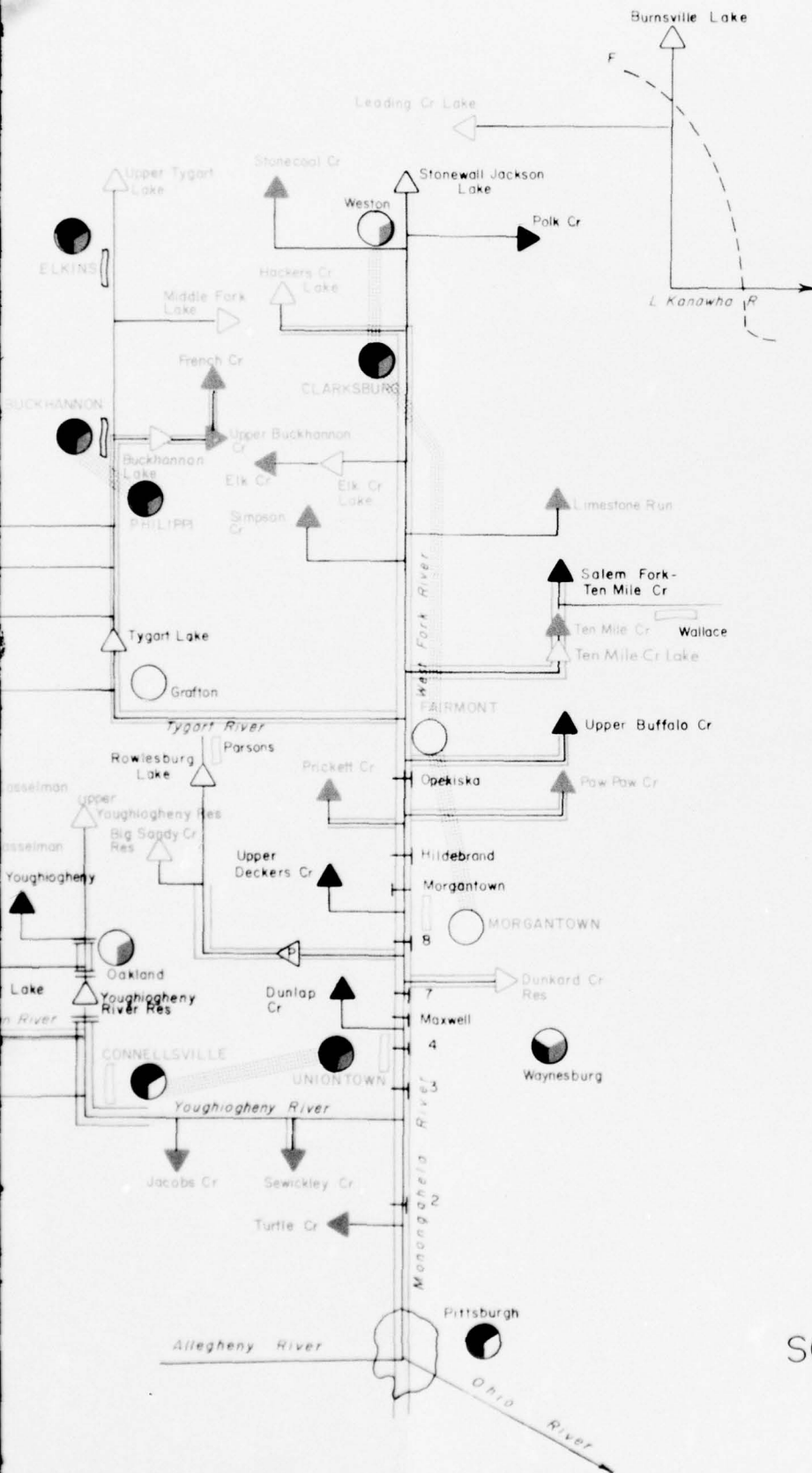
MONONGAHELA
LOCALITY



LEGEND
 DARY
 80
 R
 RSHED PROJECT
 SHED PROJECT

MONONGAHELA RIVER BASIN LOCATION MAP





LEGEND

NEEDS

- WATER QUALITY
- ◐ WATER SUPPLY
- ◑ FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980

- △ MAJOR RESERVOIR, P INDICATES NON-FEDERAL OWNER
- ▲ UPSTREAM WATERSHED PROJECT
- ▬ LPP PROJECT
- ⊥ LOCK & DAM

PLANNING ALTERNATIVES

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT
- ▬ LOCAL PROTECTION PROJECT

OTHER

- TOWNNAME PRIMARY GROWTH CENTER
- Town Name SECONDARY GROWTH CENTER
- ▬ SCENIC RIVER
- ▬ STREAM AFFECTED BY POLLUTION
- ▬ CONTINUOUSLY
- ▬ INTERMITTENTLY

MONONGAHELA RIVER BASIN
SCHEMATIC OF WATER NEEDS
AND
ALTERNATIVE SOLUTIONS

3

Beaver River Basin */

Subdivision B-1

Entire Shenango River Basin. (See Figure 12-32.)

This area is part of the Sharon-New Castle-Meadville**/ Primary Growth Center, whose area of influence carries across the Beaver River Basin divide to the Allegheny River Basin. The area for effectual water resources developments extends from Pymatuning Lake to the mouth of the Beaver River where there is a correlation with Subdivision B-2.

Sharon-New Castle. Located just downstream from Shenango River Reservoir, the Sharon urban area to New Castle, is well situated for future growth with the aid of water resources investment management. Flood problems are well controlled, water supply and quality flows appear to be ample, and amenity and aesthetic opportunities are provided by the combined storage capacities of the Federal Shenango River Reservoir and the Commonwealth's Pymatuning Reservoir. The major remaining problem is flooding of the lower plains of the Neshannock Creek Valley. Annual flood damages currently under study amount to approximately \$101,000 in the lower industrialized valley, and \$25,000 in upstream occupied areas. Low-lying flood plain lands along Neshannock Creek, amounting to more than 150 acres, require protection for future urban needs.

Guidance for growth in Lawrence County has been furnished by completed flood plain information studies along Shenango and Neshannock Rivers. There presently appears to be no extensive need for additional flood control, water quality improvement or water supply. It is expected that such needs may result from continued efforts to accelerate industrial expansion and diversification (adjustments in the industrial mix) in undeveloped flood plains.

An upstream watershed project on Shenango and Little Shenango Rivers below the Pymatuning Lake area is expected to be completed and in operation by 1980. It will provide some flood control to the predominately rural area centered on Greenville, located just upstream from Shenango River Reservoir. The study of the Neshannock Creek Valley by the Corps of Engineers will indicate possible solutions to current rural and urban flood problems which are constraining growth. For this purpose, potential

*/ See Figure 12-35 for additional features discussed by subdivision of the basin.

**/ See preceding discussion of Meadville, Pennsylvania, Allegheny River Subdivision A-2.

Pymatuning Res.
 (Existing-State)
 F.C. - 84,400 ac.ft.
 Dependable Flow
 Gross - 175 cfs
 Net - 175 cfs

Shenango R. Res.
 (Existing)
 F.C. - 180,900 ac.ft.
 Dependable Flow
 Gross - 250 cfs
 Net - 75 cfs

Little Shenango R., W.S.
 (Authorized)
 4 reservoirs - (3 mp)
 F.C. - 7,246 ac.ft.

NEW CASTLE

Totals from Neshannock Cr. Basin
 F.C. (Potential) 22,600 ac.ft.
 Dependable Flow
 Gross (Potential) - 44 cfs
 Net (Potential) - 33 cfs

Totals from Shenango R.
Basin at New Castle
 F.C. (Existing) - 272,546
 F.C. (Potential) - 295,146
 Dependable Flow
 Gross (Existing) - 275 cfs
 Gross (Potential) - 308 cfs
 Net (Existing) - 250 cfs
 Net (Potential) - 283 cfs

SHENANGO RIVER BASIN

11-12-153

Figure 12- 32

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reservoir sites have been identified on Otter Creek, Little Neshannock Creek, and West Branch Little Neshannock Creek, and local channel improvements have been considered through the New Castle urban area. These reservoir sites, in addition to providing protection from flooding, could furnish water supply for a combined potential yield of 16 MGD. Timely implementation of protection works for this portion of New Castle, supplemented by flood plain planning and regulation, will be needed for economic development.

Subdivision B-2

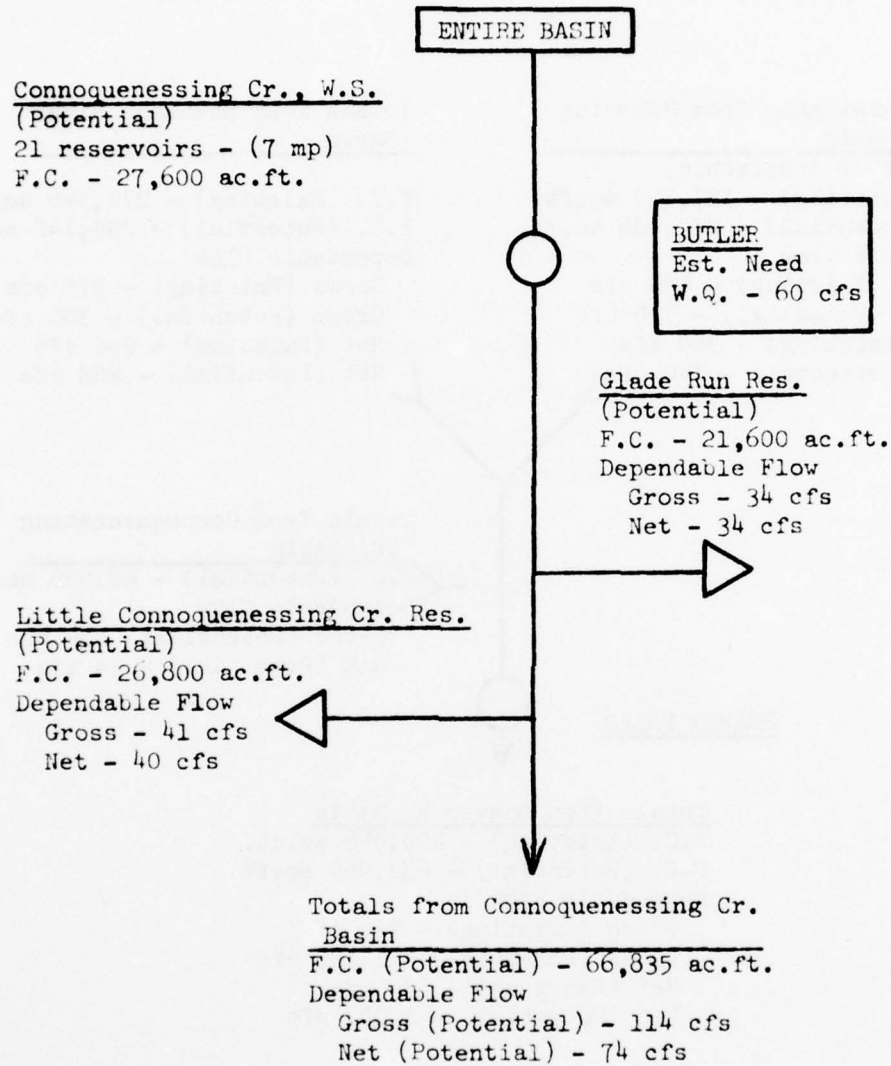
Entire Beaver River Basin exclusive of Shenango River Basin.
(See Figures 12-33 and 12-34.)

Warren-Youngstown. Development of one of the alternative potential Grand River Reservoir sites, or equivalent, and of Eagle Creek Reservoir would be best to furnish the wide variety of needs in this highly urbanized area. A systems study of tradeoffs should be considered between reservoirs in the total Beaver River Basin. Water quality and water supply are needed in this industrial complex area where headwater location limits available reservoir sites of substantial storage capacity. Upstream watershed developments should be further considered. Authorized Eagle Creek Reservoir is probably the outstanding opportunity for solution to some urban problems.

Greater Pittsburgh (B-2). Butler, Zelienople and Ellwood City along Connoquenessing Creek, and Beaver Falls at the mouth of the Beaver River, are major growth points requiring water developments within the Beaver River portion of the Greater Pittsburgh Regional Growth Center.

Butler. The City of Butler and upstream and downstream areas have a number of water related growth constraints, shown schematically, which appear to be minimal. For example, flood damage in the heavily developed portion of the urban area has been effectively reduced by the existing local protection project, but immediately upstream, where growth is being stimulated, annual damages to existing developments amount to approximately 25,000 dollars. Unused flood plain lands require protection to induce or support more active development. Obtaining water supply from the Allegheny River Basin is limited in quantity by the Commonwealth. An estimated 150 MGD will be needed by year 2020, obtainable either from additional sources within the Connoquenessing Creek Basin (see below) or from additional withdrawals from the Allegheny River, or (with future arrangement) by purchase of storage in some existing or potential reservoir for replacement of flows in the Allegheny River Basin.

Water quality control requires reduction or control of acid drainage from strip mines along Slippery Rock Creek. Minimum flows on the order of 70 cfs will be required in Connoquenessing Creek by year 2020 to assimilate residual waste after secondary treatment. Extensive expansion, outward



CONNOQUENESSING CREEK BASIN

Figure 12-33

Totals Available from Mahoning
River Basin

(Outside of Appalachia)

F.C. (Existing) - 127,500 ac.ft.

F.C. (Potential) - 270,988 ac.ft.

Dependable Flow

Gross (Existing) - 430 cfs

Gross (Potential) - 790 cfs

Net (Existing) - 380 cfs

Net (Potential) - 740 cfs

Totals from Shenango River
Basin

F.C. (Existing) - 272,546 ac.ft.

F.C. (Potential) - 295,146 ac.ft.

Dependable Flow

Gross (Existing) - 275 cfs

Gross (Potential) - 308 cfs

Net (Existing) - 250 cfs

Net (Potential) - 283 cfs

Totals from Connoquenessing
Cr. Basin

F.C. (Potential) - 66,835 ac.ft.

Dependable Flow

Gross (Potential) - 114 cfs

Net (Potential) - 74 cfs

BEAVER FALLS



Totals from Beaver R. Basin

F.C. (Existing) - 400,046 ac.ft.

F.C. (Potential) - 632,969 ac.ft.

Dependable Flow

Gross (Existing) - 730 cfs

Gross (Potential) - 1,197 cfs

Net (Existing) - 630 cfs

Net (Potential) - 1,097 cfs

BEAVER RIVER BASIN

Figure 12-34

from the present city limits of Butler, which has begun will probably cause additional pollution problems.

Development of upstream watershed projects in Connoquenessing Creek would probably reduce flood damages by about 75 percent, if fully implemented. A limited amount of channel improvement could probably eliminate rural area flood damages and also free presently unused flood plain lands for future urban use. These impoundments could possibly furnish adequate water supply and additional stream flow for quality control. Additional good quality water could be made available from combined development of potential SCS and C of E larger downstream tributary impoundments on Little Connoquenessing Creek and Glade Run.

Zelienople-Ellwood City. The area of Connoquenessing Creek from below Butler to the mouth is jointly under study by SCS and C of E. Current annual flood damages approximate 309,000 dollars. This flooding inhibits industry expansion at Ellwood City and other points in the valley. Water supply throughout this part of the valley is short. Future growth must be supported by additional sources, such as those mentioned above. Water resource development, including multiple-purpose reservoirs, particularly on Glade Run and Little Connoquenessing Creek, and channel improvement in the vicinity of Zelienople and Renfrew would reduce current flood damages by about 80 percent and provide needed sources of water supply.

Beaver Falls. Growth in the area extends from the south of the Beaver River below Beaver Falls upstream to about Wampum, near the mouth of Connoquenessing Creek. Growth is now hampered by annual flood damages of about 40,000 dollars. These damages could be reduced to about \$10,000 as a by-product of the potential reservoir project in the Grand River Basin (by diverting flood runoff from the Mahoning River Basin). Water supply and quality control will be maintained by flows from the upstream area of the Beaver River. Local protection facilities are needed at isolated points to lessen flood damages and to decrease flood hazards on potentially developable flood plain lands. Eagle Creek Reservoir would not be as effective, but would add to the upstream controlled area, and provide additional storage capacity.

Continued development of Moraine State Park, development of Buffalo Creek State Park, a regional park - scenic river development on adjacent Little Beaver Creek, and a water-related recreation area on Raccoon Creek would further enhance this area. The latter group of recreation facilities and Eagle Creek Reservoir may more advance development goals than the larger more concentrated water resource project.

Other Considerations

The preceding analysis and schematic representations of the water and related resources in the Beaver River Basin have been applied not only

to the designated growth centers and their associated problems but also to a wider area of involvement with the Warren-Youngstown, Ohio, industrial complex. For regional planning, the best solutions are only expressed in relation to the known situation, tempered by trends indicated by benchmark projections. The plan for the Beaver River Basin merits disproportionate attention due to its locational advantages for development from the Greater Pittsburgh Regional Growth Center to Megalopolis due north from Beaver-Butler Counties via Mercer-Crawford-Erie Counties, in Appalachia Pennsylvania, Columbiana-Trumbull-Mahoning-Ashtabula Counties, in non-Appalachia Ohio, and Chautauqua-Cattaraugus Counties, in Appalachia New York. Other communities throughout the Beaver River Basin will quite naturally develop problems associated with this growth and expansion. Current annual flood damages in the upstream watershed areas average 670,000 dollars. Additional water supply will be required and water quality problems will require attention. Additional continuing studies throughout this area are needed to locate problems and suggest resolutions before the problem further constrains growth.

The headwater location of the Warren-Youngstown complex is to some extent a growth constraint. The four existing Federal reservoirs and one existing state reservoir listed below, with limited multiple-purpose use, are probably a greater constraint than realized because of the swath of growth which they must support. The Lake Erie-Ohio River Canal is probably a dead issue without combined Pennsylvania-Ohio sponsorship. The potential Grand River Reservoir lacks Ohio and local county sponsorship and backing. Tradeoffs between existing projects may furnish some alleviation of problems. However, even with the latter project, water demands for Akron assume significant future importance. The effect of Beaver River Basin water resources developments also reaches below into the upper Ohio River area and the Greater Wheeling Regional Growth Center.

The unsatisfied needs and those which must also be considered in plan development, for future urban development of the Beaver River Basin, may be the most critical future determinants of growth possibilities within the time frame to year 2020.

Beaver River Basin Plan Component. This portion of the comprehensive water resources development plan for Appalachia, which includes contiguous areas outside of Appalachia, would include the following:

Projects in operation or expected to be in place by 1980:

Commonwealth of Pennsylvania

Pymatuning Reservoir^{*/}

^{*/} See Pennsylvania Water Supplement, Main Report, Part V.

Corps of Engineers */

Shenango River Reservoir
West Branch Mahoning Creek Reservoir**/
Berlin Reservoir**/
Mosquito Creek Reservoir**/

USDA Upstream Watershed Projects ***/

Saul-Mathay
Little Shenango River
Mill Run
Upper Grave Creek
Harmon Creek
Wheeling Creek

For Continued Planning:

USDA Upstream Watershed Projects ****/

Connoquenessing Creek *****/
Slippery Rock Creek
Short Creek
Kings Creek

Future Studies

Comprehensive study is needed of the entire Beaver River Basin, emphasizing present water supply and water quality; future water supply, water quality, recreation and other growth problems relevant to Warren-Youngstown, Ohio; the effect on the non-Appalachian part of the growth area of Eagle Creek and other Mahoning River developments; flood plain planning, regulation and development in Shenango River and Neshannock Creek Valleys at New Castle by joint multiple-purpose upstream watershed developments and channel improvements in the developmental flood plain areas of the Sharon-New Castle reach and the reach from there to the river mouth; Connoquenessing Creek, including Slippery Rock Creek and

*/ See Table 11-4, Chapter 11, Part II.

**/ Contiguous to Appalachia.

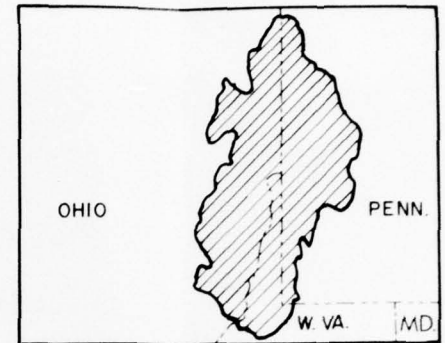
***/ See Table 11-7, Chapter 11, Part II.

****/ See Appendix A for pertinent data.

*****/ For Early Action.

tributaries, especially for water supply and water quality, and recreation, for the City of Butler and upstream and downstream growth areas to the Beaver River; Mahoning River Basin in Appalachia Ohio, for improvement of river flow down to the Pennsylvania state line to meet interstate water quality requirements; and flood plain information studies along the Beaver River in Beaver County, Pennsylvania. A comprehensive basin-wide pollution abatement study, particularly acid mine drainage, as in preceding basin plan components.

Basin map and accompanying schematic diagram is shown in Figure 12-35.



VICINITY MAP

LEGEND

— STATE PLANNING SUB-REGION BOUNDARY
EXPECTED TO EXIST BY 1980



MAJOR RESERVOIR



UPSTREAM WATERSHED PROJECT

PLANNING ALTERNATIVES



MAJOR RESERVOIR



UPSTREAM WATERSHED PROJECT

UPSTREAM WATERSHED PROJECT IDENTIFICATION

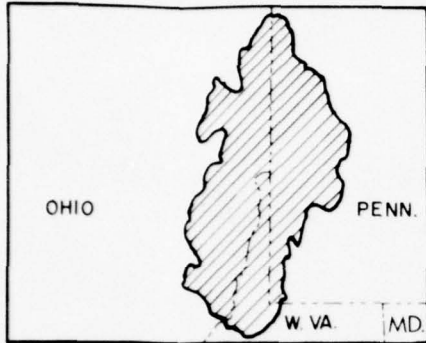
EXPECTED TO EXIST BY 1980

- 19 Sandy Creek
- 4 Saul-Mathay Creek
- 5 Upper Grave Creek
- 9 Harmon Creek
- 12 Little Shenango River
- 76 Wheeling Creek

PLANNING ALTERNATIVE

- 8 Short Cr
- 25 Connoqueessing
- 62 Ray-crook Creek
- 61 Kings Cr

BEAVER RIVER BASIN OHIO
MAIN STEM
B-1, B-2, O-1
LOCATION MAP



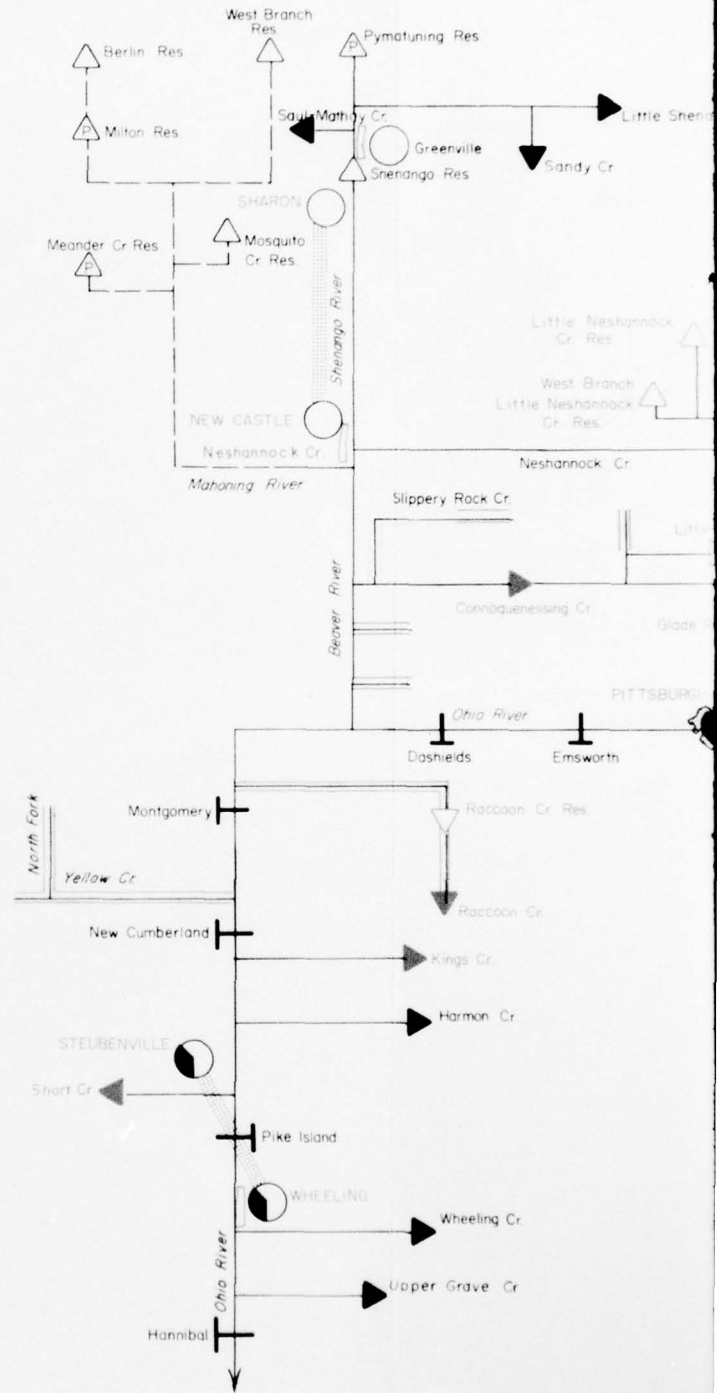
VICINITY MAP

PLANNING SUB-REGION BOUNDARY
BY 1980

RESERVOIR
WATERSHED PROJECT

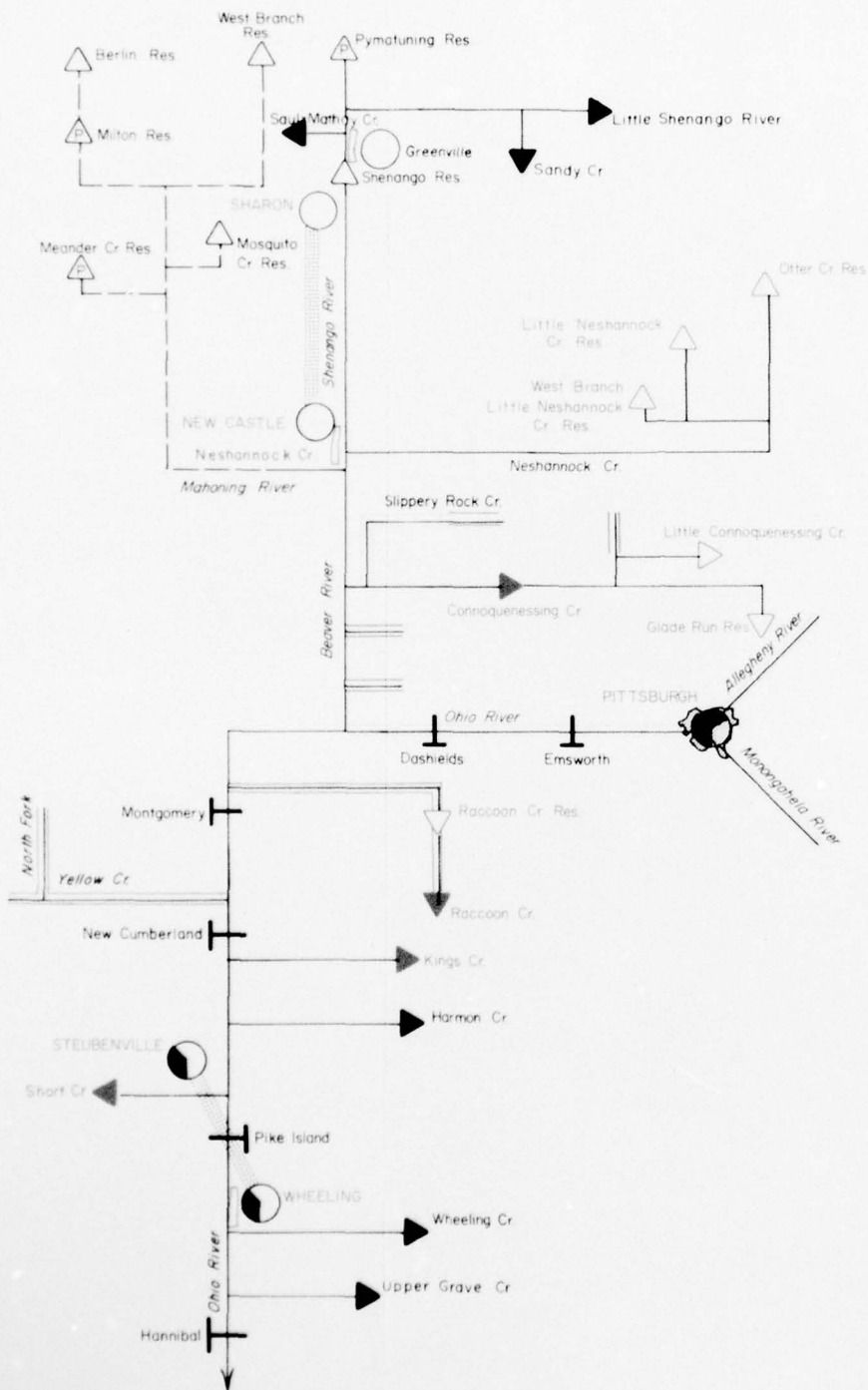
RESOURCES

RESERVOIR
WATERSHED PROJECT





OHIO RIVER & OHIO
IN STEM
1,8-2,0-1
ION MAP

2





LEGEND

NEEDS




-  WATER QUALITY
-  FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

-  MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
-  UPSTREAM WATERSHED PROJECT

PLANNING ALTERNATIVES:



-  MAJOR RESERVOIR
-  UPSTREAM WATERSHED PROJECT
-  LOCAL PROTECTION PROJECT

OTHER

 LOCK AND DAM

TOWN NAME PRIMARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

-  CONTINUOUSLY
-  INTERMITTENTLY

BEAVER RIVER & OHIO
MAIN STEM
B-1, B-2, O-1

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

Ohio River Main Stem */

Subdivision 0-1

Head of Ohio River (Pittsburgh) to Ohio River Mile 127.2
excluding the Beaver River Basin. (See Figures 12-36 and 12-37.)

The following discussion applies to major growth points from the head of the Ohio River through the upper pool of Hannibal Locks and Dam, including Chartiers Creek and Raccoon Creek. Allegheny River and Monongahela River controlled flows resulting from systems operational effects are reflected in the triadic diagram and flow schematics.

Chartiers Creek: Washington-Canonsburg. Because of amenable natural surroundings and improved infrastructure, including a new four-lane limited access highway system, this southwestern Pittsburgh area is a most desirable industrial location. Existing local protection through the City of Washington protects a large part of the industrialized area, except at its upstream and downstream ends, above and below the city, where diversified industrial land uses are accelerating. Current annual flood damages to existing developments in Chartiers Creek below Washington, and continuing through Houston, Canonsburg, Bridgeville and Carnegie amount to about 983,000 dollars. Local flood protection projects now under construction will be completed before 1980 in the Carnegie-Bridgeville reach and the Canonsburg-Houston reach, reducing these annual damages to about 57,000 dollars. Future flood plain use, for urban development including recreation, will require flood plain planning and regulation of stream acreage, and extension of protection, from Washington downstream through the Arden Downs-Meadowlands reach to connect with the newer protection work at Houston. This will protect future industrial sites, including potential expansion at Meadowlands by the Radio Corporation of America. From Canonsburg to Bridgeville, future developments involving fair amounts of acreage along a 10-mile stretch of the creek will depend on protective and regulatory flood plain measures to accompany access provided by Interstate Highway 79. Another potentially developable reach of Chartiers Creek, closer to potential Pittsburgh area urban expansion, is downstream of the latest improvements. From Scully Yard to McKees Rocks, Pennsylvania, at the Ohio River, developable plains situated favorably for industrial development are hampered by periodic flooding. Favorable development of this area requires investigation of protective works extension down the creek to the Ohio River.

As development progresses, communities of this valley will undoubtedly have water supply needs, depending on the future need for flood plain areas for urban use. This entire creek area, and contiguous areas, also,

*/ See Figures 12-35 and 12-50 for additional features discussed.

OHIO RIVER MAIN STEM

Totals from Allegheny R. Basin

F.C. (Existing) - 1,936,276 ac.ft.

F.C. (Potential) - 2,951,131 ac.ft.

Dependable Flow

Gross (Existing) - 2,990 cfs

Gross (Potential) - 5,147 cfs

Net (Existing) - 2,068 cfs

Net (Potential) - 4,225 cfs

Totals from Monongahela R. Basin

F.C. (Existing) - 781,066 ac.ft.

F.C. (Potential) - 1,663,869 ac.ft.

Dependable Flow

Gross (Existing) - 2,739 cfs

Gross (Potential) - 4,722 cfs

Net (Existing) - 2,389 cfs

Net (Potential) - 4,372 cfs

Totals from Beaver R. Basin

F.C. (Existing) - 400,046 ac.ft.

F.C. (Potential) - 632,969 ac.ft.

Dependable Flow

Gross (Existing) - 730 cfs

Gross (Potential) - 1,197 cfs

Net (Existing) - 630 cfs

Net (Potential) - 1,097 cfs

PITTSBURGH

Raccoon Cr. W.S.

(Potential)

3 mp reservoirs

F.C. - 3,140 ac.ft.

Raccoon Cr. Res.

(Potential)

F.C. - 55,900 ac.ft.

Dependable Flow

Gross - 100 cfs

Net - 92 cfs

Kings Cr. W.S.

(Potential)

2 reservoirs (1 mp)

F.C. - 7,475 ac.ft.

STEUBENVILLE

Short Cr. W.S.

(Potential)

6 reservoirs (1 mp)

F.C. - 6,555 ac.ft.

WHEELING

Harmon Cr. W.S.

(Authorized)

14 reservoirs (1 mp)

F.C. - 3,127 ac.ft.

Wheeling Cr. W.S.

(Authorized)

7 reservoirs (1 mp)

F.C. - 31,421 ac.ft.

Totals from Ohio River Basin at

End of Sub-region F

F.C. (Existing) - 3,151,936 ac.ft.

F.C. (Potential) - 5,355,587 ac.ft.

Dependable Flow

Gross (Existing) - 8,087 cfs

Gross (Potential) - 12,760 cfs

Net (Existing) - 5,087 cfs

Net (Potential) - 9,766 cfs

OHIO RIVER MAIN STEM

Figure 12- 36

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CORPS OF ENGINEERS CINCINNATI OHIO

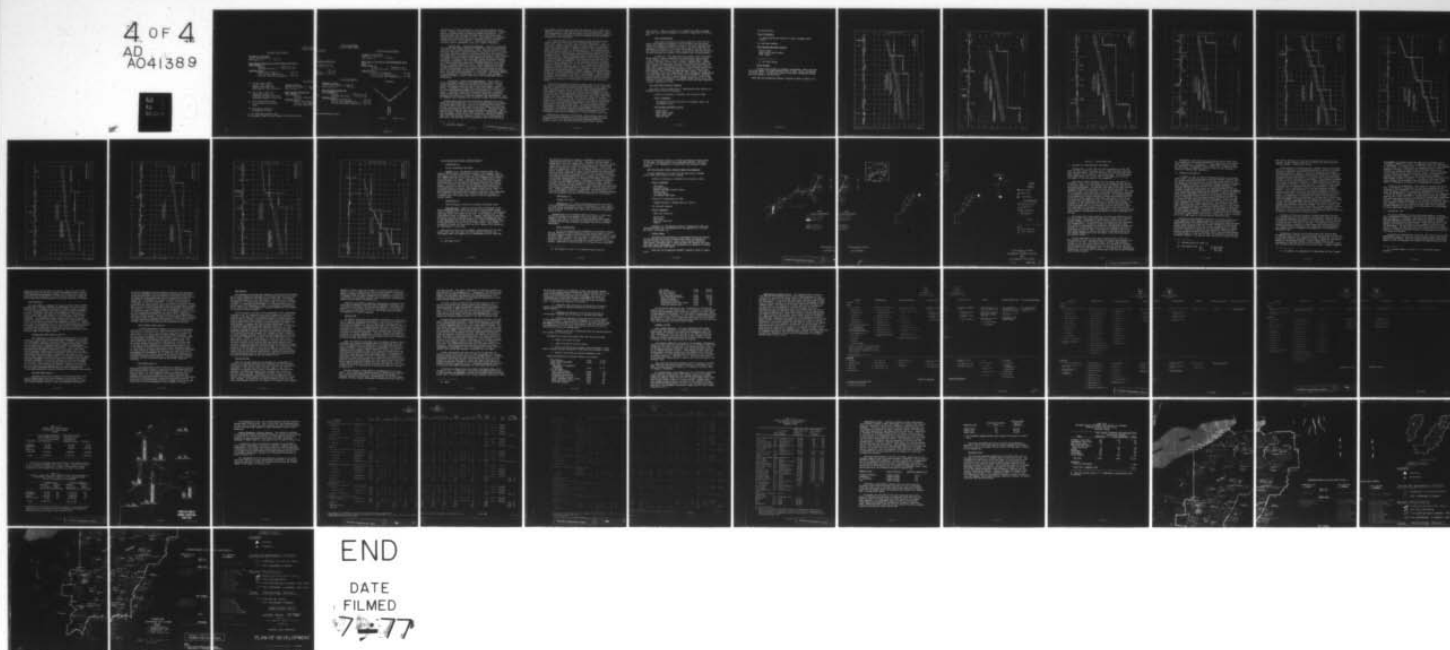
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DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. MAIN REPORT. PART--ETC(U)
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ALLEGHENY RIVER PORTION

Estimate of Gross Needs

Current Flood Damage 1/ - \$285,000
Water Quality 2/ - 2000 cfs

Water Resource Availability from Allegheny River Basin
Flood Control 3/

Existing - 1,588,000 ac. ft.
Potential Additional - 465,600 ac. ft.*
Dependable Flow 4/
Natural Low Stream Flow - 922 cfs.
Existing Total Augmented Flow - 3000 cfs.
Potential Additional Augmentation - 2147 cfs.

OHIO RIVER

1/ Average Annual Damages
based on 1969 Degree of
Economic Development and
1980 Degree of Flood Protection.

Estimate of Needs
Current Flood Damage 1/ - \$407,
Water Quality 2/ - 7800

2/ Min. 7 day, 1 year in 10,
stream flow required to
assimilate residual waste after
secondary treatment in Year 2020.

Water Resource Availability
Flood Control 3/
Existing
Potential Additional
Dependable Flow 4/
Natural Low Stream Fl
Existing Total Augmen
Potential Additional

3/ Only storage having affect
on flood stage at Pittsburgh
shown.

4/ Flow that is equaled or
exceeded 90% of time.

* St. Petersburg Reservoir only.
** Big Sandy, Laurel Hill and Dunkard Creek Reservoirs only.

GREATER PITTSBURGH
REGIONAL GROWTH CENTER

ER PORTION

Allegheny River Basin

1,588,000 ac. ft.
465,600 ac. ft.*
- 922 cfs.
Flow - 3000 cfs.
Augmentation - 2147 cfs.

OHIO RIVER PORTION

Estimate of Needs

Current Flood Damage 1/ - \$407,000
Water Quality 2/ - 7800 cfs.

Water Resource Availability

Flood Control 3/
Existing - 2,316,600 ac. ft.
Potential Additional - 737,000 ac. ft.
Dependable Flow 4/
Natural Low Stream Flow - 1700 cfs.
Existing Total Augmented Flow - 6200 cfs.
Potential Additional Augmentation - 3650 cfs.

ard Creek Reservoirs only.

MONONGAHELA RIVER PORTION

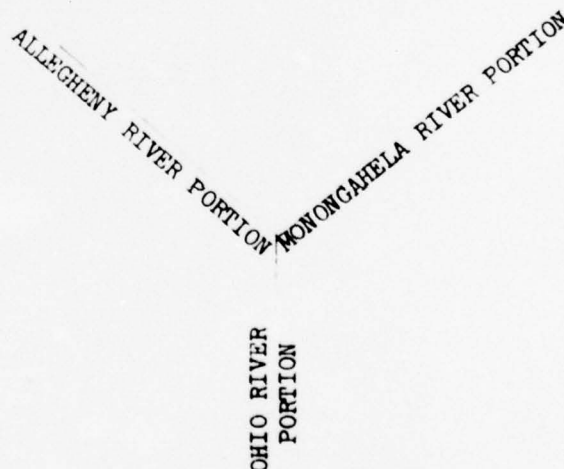
Estimate of Gross Needs

Current Flood Damage 1/ - \$304,000
Water Quality 2/ - 4350 cfs

Water Resource Availability From Monongahela River Basin

Flood Control 3/
Existing - 728,600 ac. ft.
Potential Additional - 271,100 ac. ft.**
Dependable Flow 4/
Natural Low Stream Flow - 350 cfs.
Existing Total Augmented Flow - 2719 cfs.
Potential Additional Augmentation - 1653 cfs.

PITTSBURGH



II-12-165

Figure 12-37

2

are important to further expansion of the Pittsburgh Regional Growth Center. Emphasis, however, needs to be placed upon prevention of urban sprawl to capitalize upon the remaining pleasant surroundings. Acid mine drainage*/ must be abated for higher use of flood plain lands. In addition, maintaining stream flows at a level adequate to assimilate residual waste loads after secondary treatment should be considered in future studies. An estimate of 75 cfs has been projected for Chartiers Creek at Washington in year 2020, based on benchmarks.

Raccoon Creek: Aliquippa-Burgettstown. Just west of Chartiers Creek Valley lies Raccoon Creek with a long broad valley containing more than 1000 acres of prime developmental lands. When provided with flood protection and readily available sources of good quality water, this area will offer potential investors an extensive opportunity for industrial development which could extend intensive urban use from Aliquippa upstream to Bridgeville along a reach offering amenity and aesthetic values of a high order. The Raccoon Creek wildflower reserve, developed by Western Pennsylvania Conservancy, and state-owned game lands could be a nucleus for a large recreational complex and a safeguard against further urban sprawl. A potential reservoir project, jointly studied with upstream watershed possibilities on upper Raccoon Creek to Burgettstown, would provide flood protection to the extensive flood plain areas and water supply and recreational opportunities to the Greater Pittsburgh Regional area. Acid mine drainage abatement is a prime need. Preliminary measures by the Commonwealth of Pennsylvania, as a prelude to more permanent solutions, presently include installation of an ion-exchange plant at Burgettstown.

Ohio River: Greater Pittsburgh-Wheeling. Premium areas for future development bestride the Ohio River from Pittsburgh downriver through Steubenville, Wheeling, New Martinsville and below. Current annual flood damages along this reach of the river amount to about \$2 million. Completion of the Rowlesburg Lake project before 1980 will reduce existing development damage, but not below about \$1.5 million annually. In addition, there are approximately 2800 acres on presently unused or under-used flood plains, and other acreage now intensively developed but available for industrial expansion and redevelopment. Both are dependent upon increased flood protection to make them more productive.

Although water supply has been projected as adequate, this is accepted with some skepticism, in view of future developmental urban needs. The largest single water user, the City of Pittsburgh, is projected to require 130 MGD in year 2020, more than any other single municipal user of river water along the Ohio River in Sub-region F. Existing flows are considered sufficient for water supply needs as now projected.*/ Water quality control, however, does present a problem. The maximum summer low-flow requirement in the Ohio River at Sewickley to assimilate residual waste load after secondary treatment, in year 2020, is projected to be 7800 cfs.*/ The flow that will be available by 1980, after Rowlesburg

*/ See FWPCA Appendix D.

and Stonewall Jackson Lakes are placed in operation, will be 6600 cfs at Sewickley, leaving a flow deficit of 1200 cfs in the Ohio River. Additional augmentation flows will be needed as industrialization intensifies and broadens, unless industrial pollution abatement measures accompany and keep pace with development.

Efficient solutions to the flood hazard include incremental flood control storage at facilities in the Monongahela River Basin. Big Sandy Creek, Dunkard Creek and Laurel Hill Creek Reservoirs, in particular would be highly effective because of their location in relation to runoff concentration times. A storage facility in the Allegheny River Basin could only be located on the Clarion River. This latter facility would consistently effect 2.5 to 3 feet reduction of flood heights along the Ohio River to beyond Wheeling, as would the three projects in the Monongahela Basin. Annual flood damages would be reduced by this facility to about \$1 million, leaving residual damage of about 500,000 dollars. The second grouping of Monongahela River projects would then effect the ultimate in damage irreducibility. The resultant profile for 100-year flood is shown in Figure 12-38. A full exposition of yearly recurrence interval is shown in Figures 12-38 - 12-47. In addition to reducing the damages to currently developed areas the lowering of flood crests would reasonably free more than 1,500 acres of desirable, vacant flood plain land for industrial development. Adequate storage to provide additional stream flow for waste assimilation would be available in multiple-purpose development at the Clarion River Site (St. Petersburg). Similar storage, provided in the Monongahela River Basin, would require multiple-purpose development of not only the three reservoir potentials mentioned, but of supplementary storage in the Youghiogheny, Tygart and West Fork River Basins.

Continued urban sprawl and aesthetic degeneration can be counteracted and part of the tremendous recreation demand generated by this large urban area can be satisfied by the four reservoir areas above supplemented by other alternative sites such as on Ten Mile Creek (Monongahela River), other potential reservoir sites and wild and scenic developments in the sub-region, and locally some smaller sites on direct drainage tributaries to the Ohio River. Developments on Yellow Creek, Short Creek, Fish Creek, Captina Creek, and upper Fishing Creek should be studied for multiple-purpose use, including recreation. The projected demand for water-related recreation for these regional growth centers in year 2020 of 279,000,000 annual visitor-days will require development of all potential water resource sites, including the Ohio River. A multiple-purpose reservoir development in the Clarion River Basin with extensive land area and facilities for recreation would provide approximately 3.5 million annual visitor-days, and the three potential reservoir developments in the Monongahela Basin, about an additional 1.0 million annual visitor-days.

Intensity and continuity of development, and locational, water resource, and mineral advantages call for flood plain information studies to blanket Ohio River-side areas throughout Columbiana-Jefferson-Belmont Counties, Ohio and Hancock-Brooks-Marshall-Wetzel Counties,

West Virginia. These are expected to be completed by 1980 to provide urban and rural community guidance for land use, regulation and development.

Other Considerations

Flood plain information and other studies will cover not only growth areas immediately adjacent to the Ohio River, but also stream reaches and community developments located on the direct draining tributaries within backwater effect of the river. Off-river locations will undoubtedly be developed as on-river sites expand or come into use and will experience needs for water supply, water quality and flood reduction. Upstream watershed developments could alleviate some of these problems.

In addition to the larger growth area needs, there are developmental needs of smaller communities not quantitatively shown directly in the schematic displays. On-river sites of Stratton-Empire, Mingo Junction, Brilliant, Martins Ferry, Bellaire, Powhatan Point, Irondale, Riverview and Clarrington need flood protection and/or water supply; Rayland, Connorville, Dillonvale and Adena, on Short Creek, Ohio, require water supply; Wilson and Woodsfield, Ohio, on Sunfish Creek require water supply and sewage treatment; and Barnesville, Ohio, on Captina Creek, and Jerusalem, Ohio, on Sunfish Creek need water supply. The State of Ohio indicates a need for a comprehensive "Ohio" development program based to provide additional support and insight into developments, including water resources, from which a growth program can evolve. State of West Virginia growth areas outside of the regional growth centers are no less important in view of potentially developable flood plain areas comparable to sister communities of Ohio.

Ohio River Main Stem Plan Component

This part of the sub-region plan of comprehensive water resource development would include the following:

Projects in operation or expected to be in place by 1980:

Corps of Engineers

All reservoirs listed previously for Allegheny, Beaver and Monongahela Rivers.

USDA Upstream Watershed Projects

Harmon Creek
Upper Buffalo Creek
Upper Grave Creek
Wheeling Creek

For Authorization:

Corps of Engineers

St. Petersburg Dam and Reservoir Project (Allegheny River Basin).

For continued planning:

USDA Upstream Watershed Projects

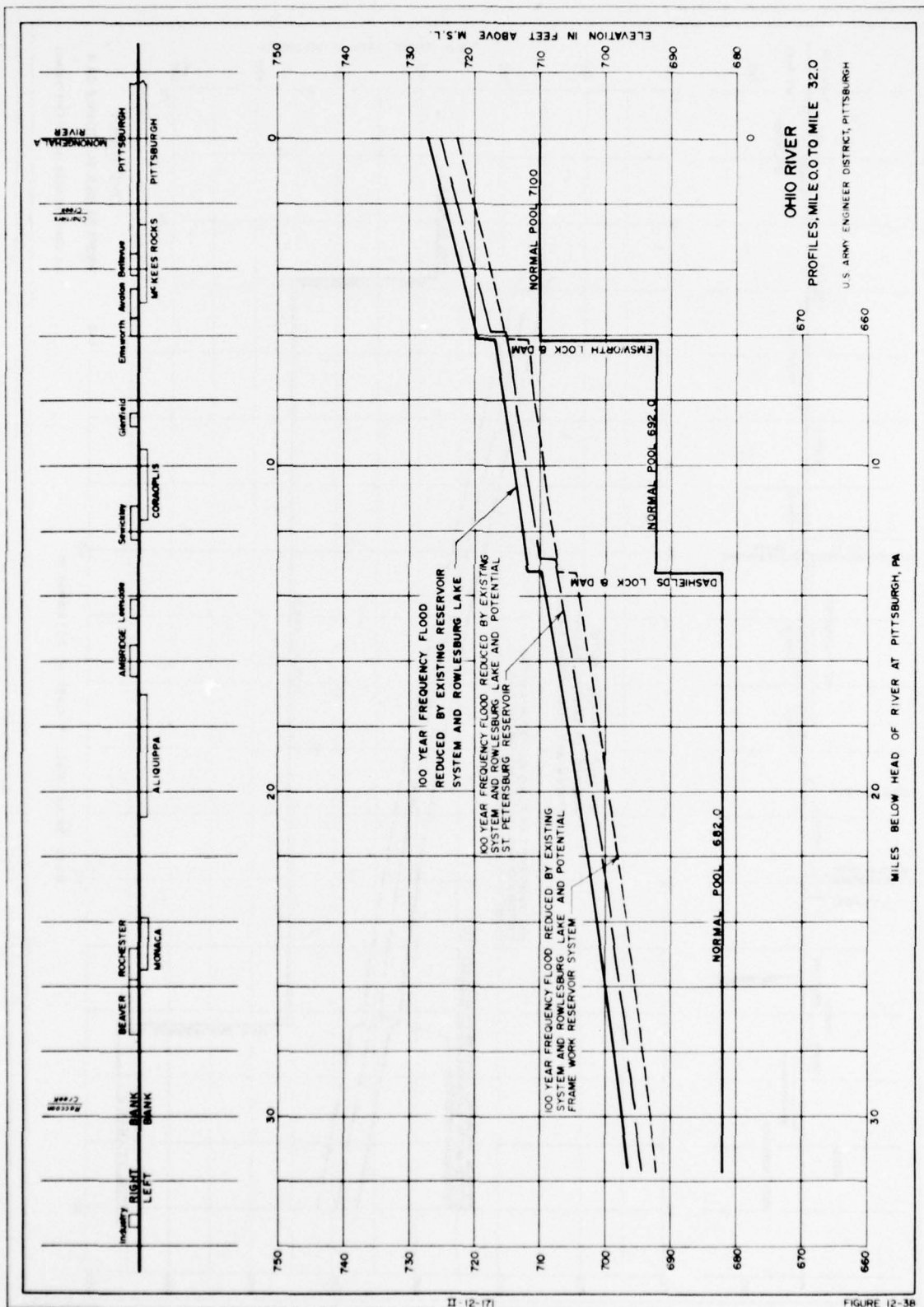
Raccoon Creek
Upper Middle Island Creek*/
Kings Creek*/

*/ For Early Action.

Future Studies

Initiate basin studies in Allegheny, Monongahela, Beaver and Upper Ohio River Basins, to include adequate study of small, direct tributaries of the Ohio River. Initiate and complete flood plain information studies along both banks of the Ohio River.

Basin map and accompanying schematic diagram is shown in Figure 12-35.



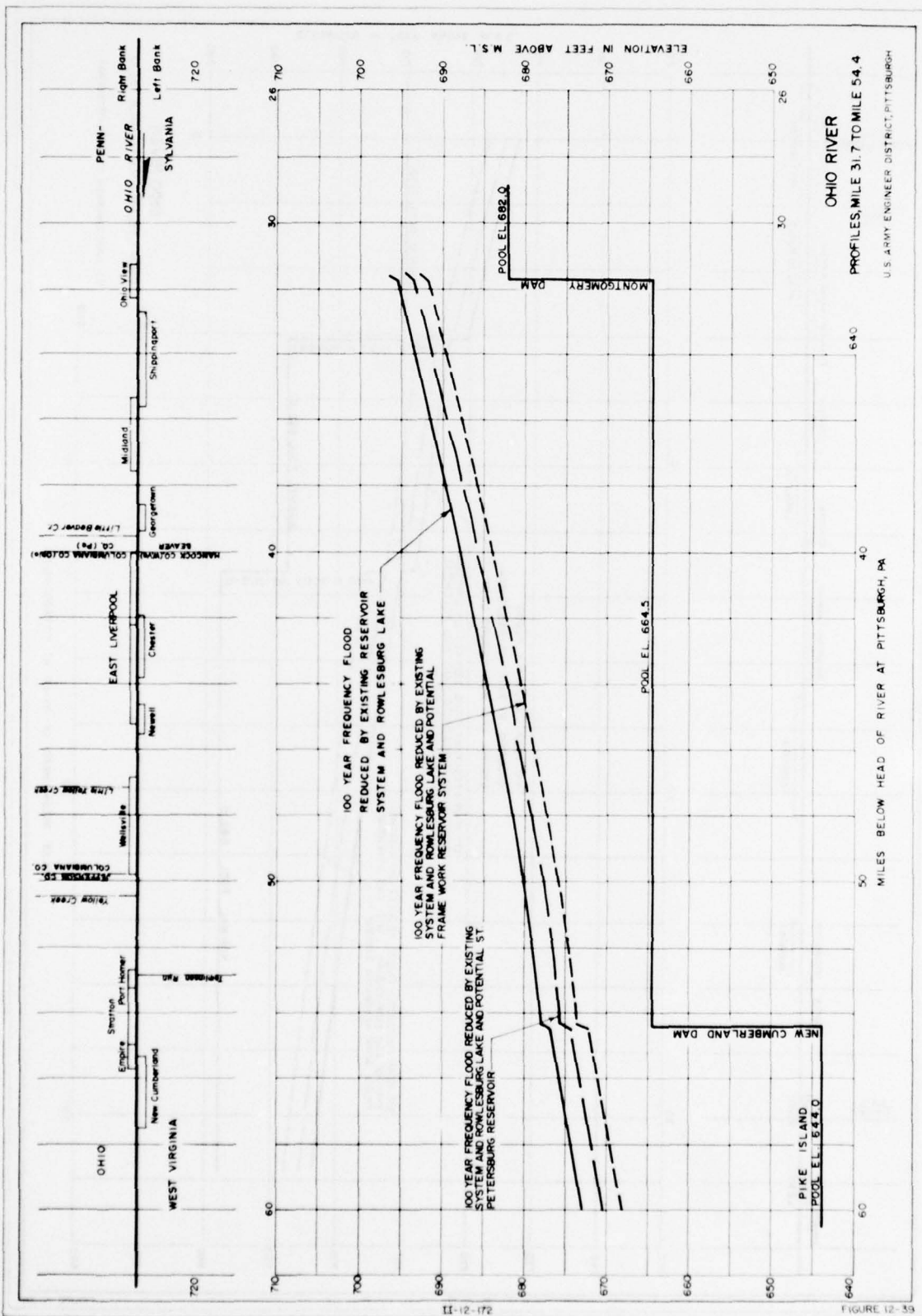
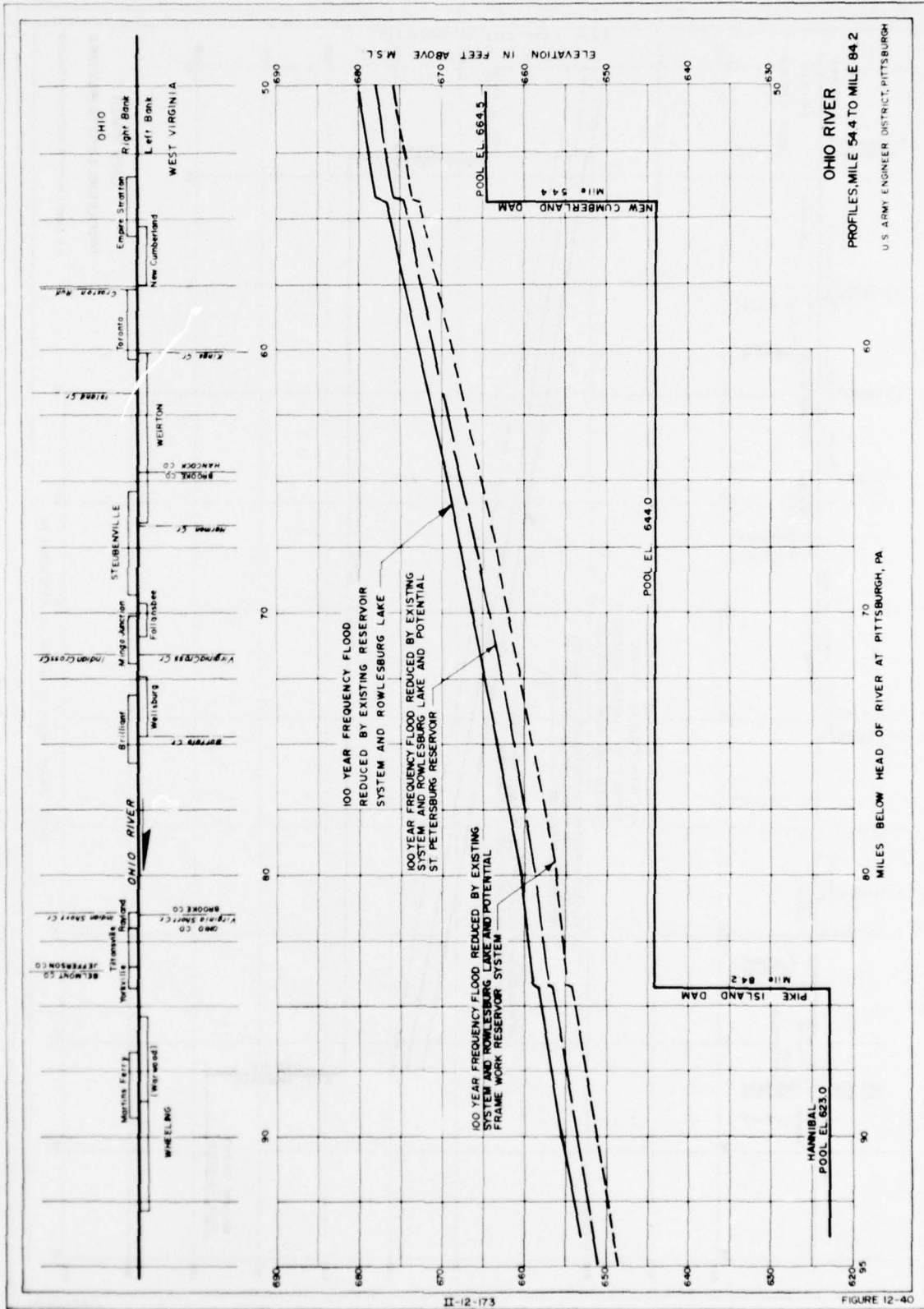
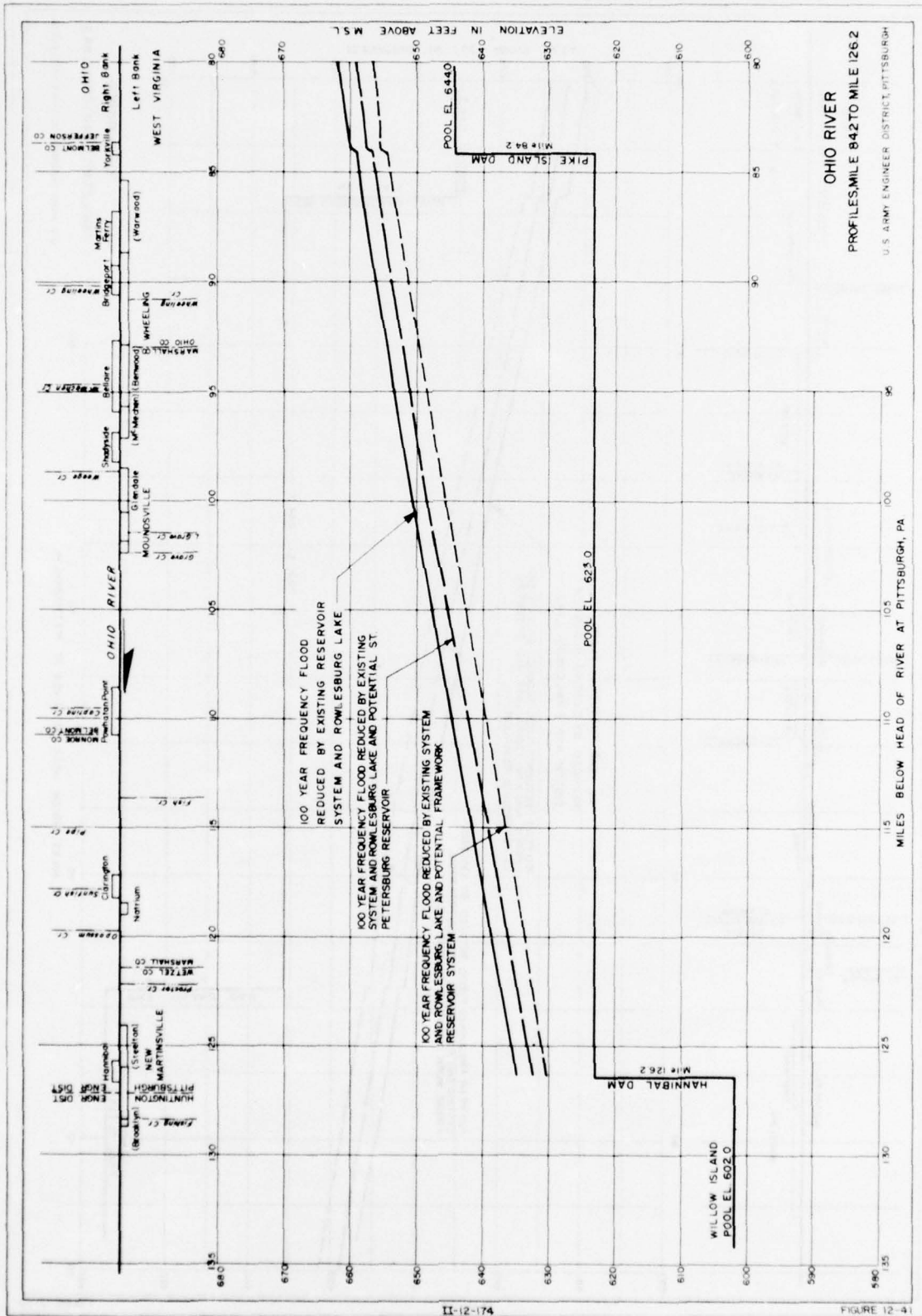
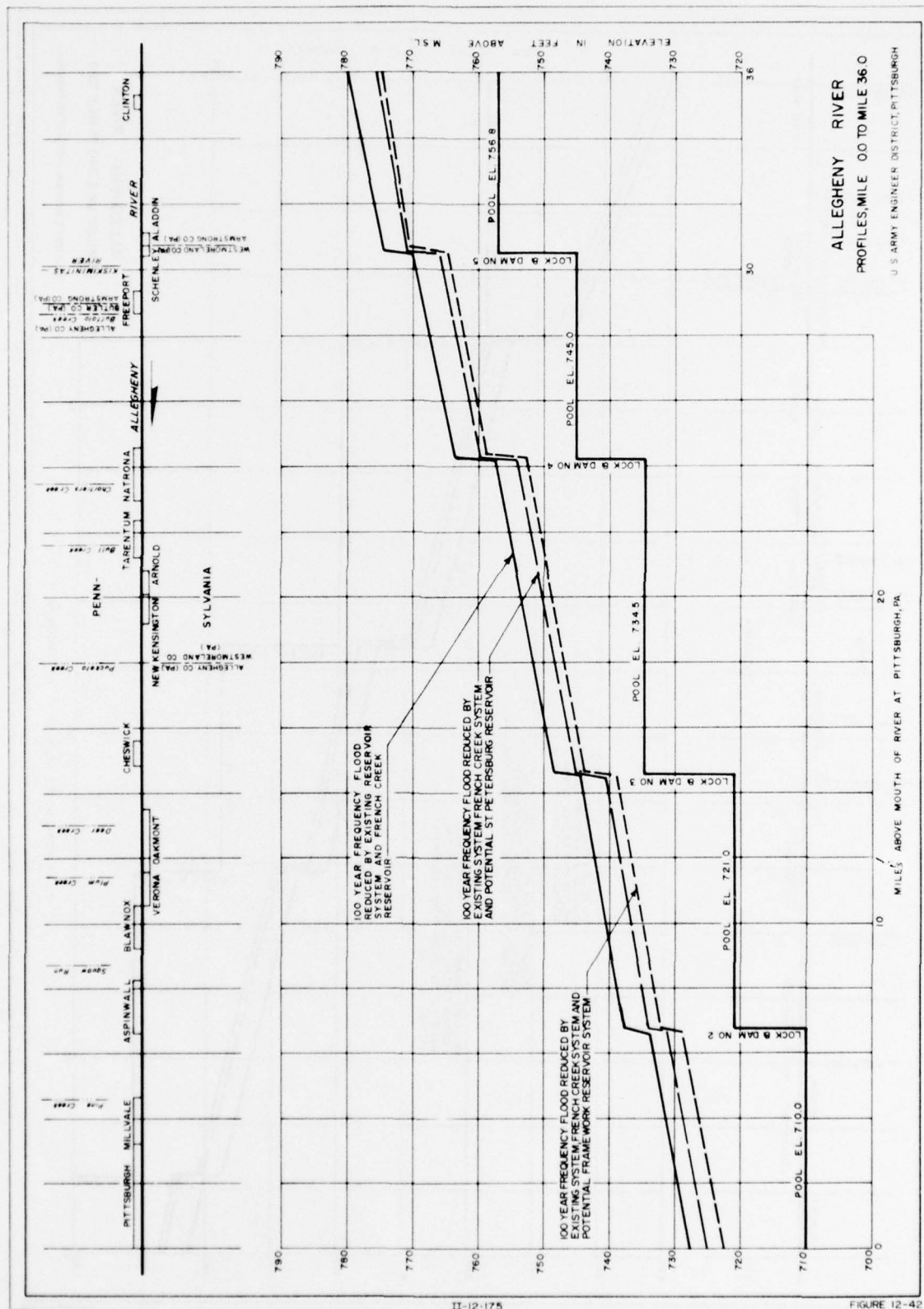
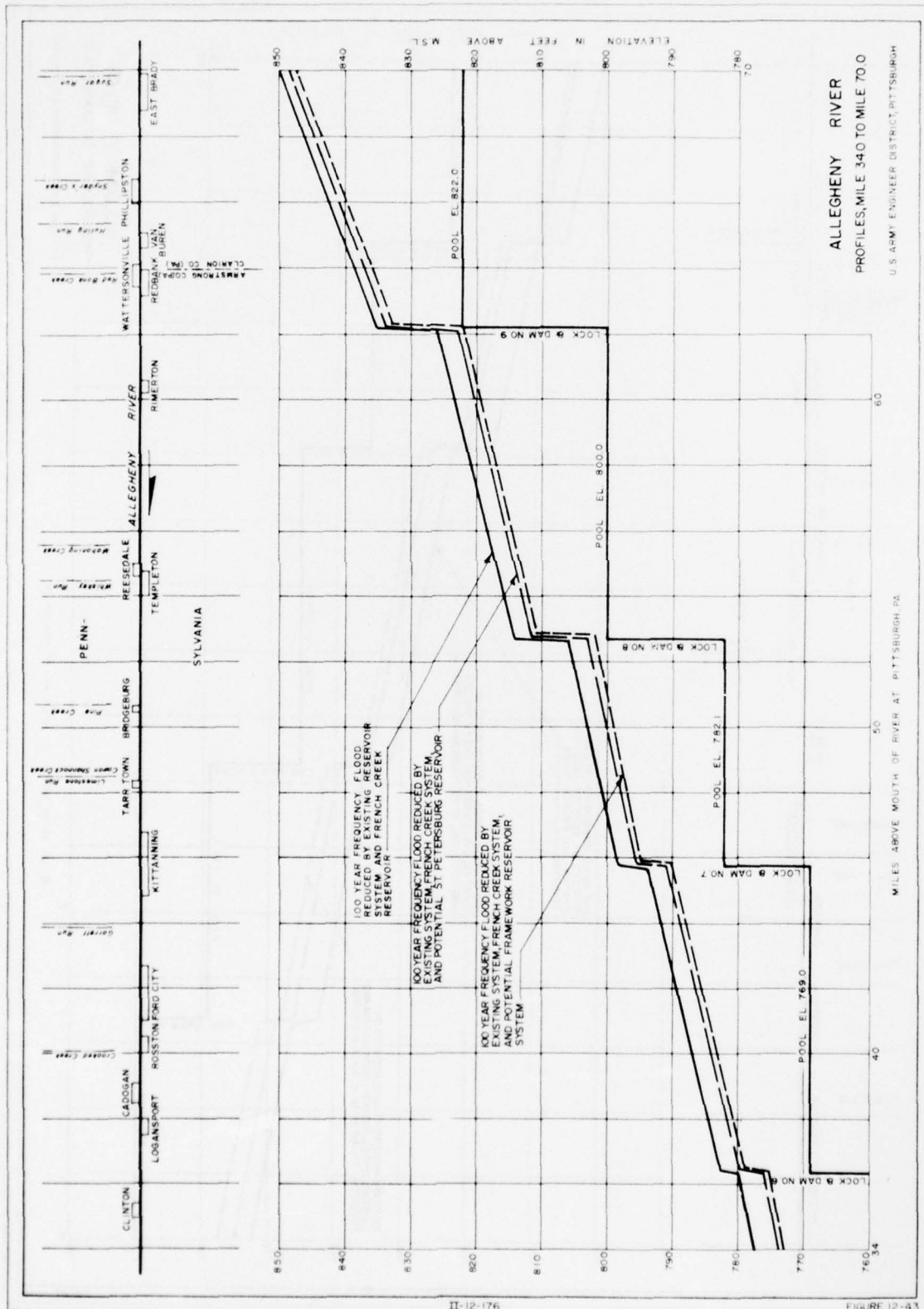


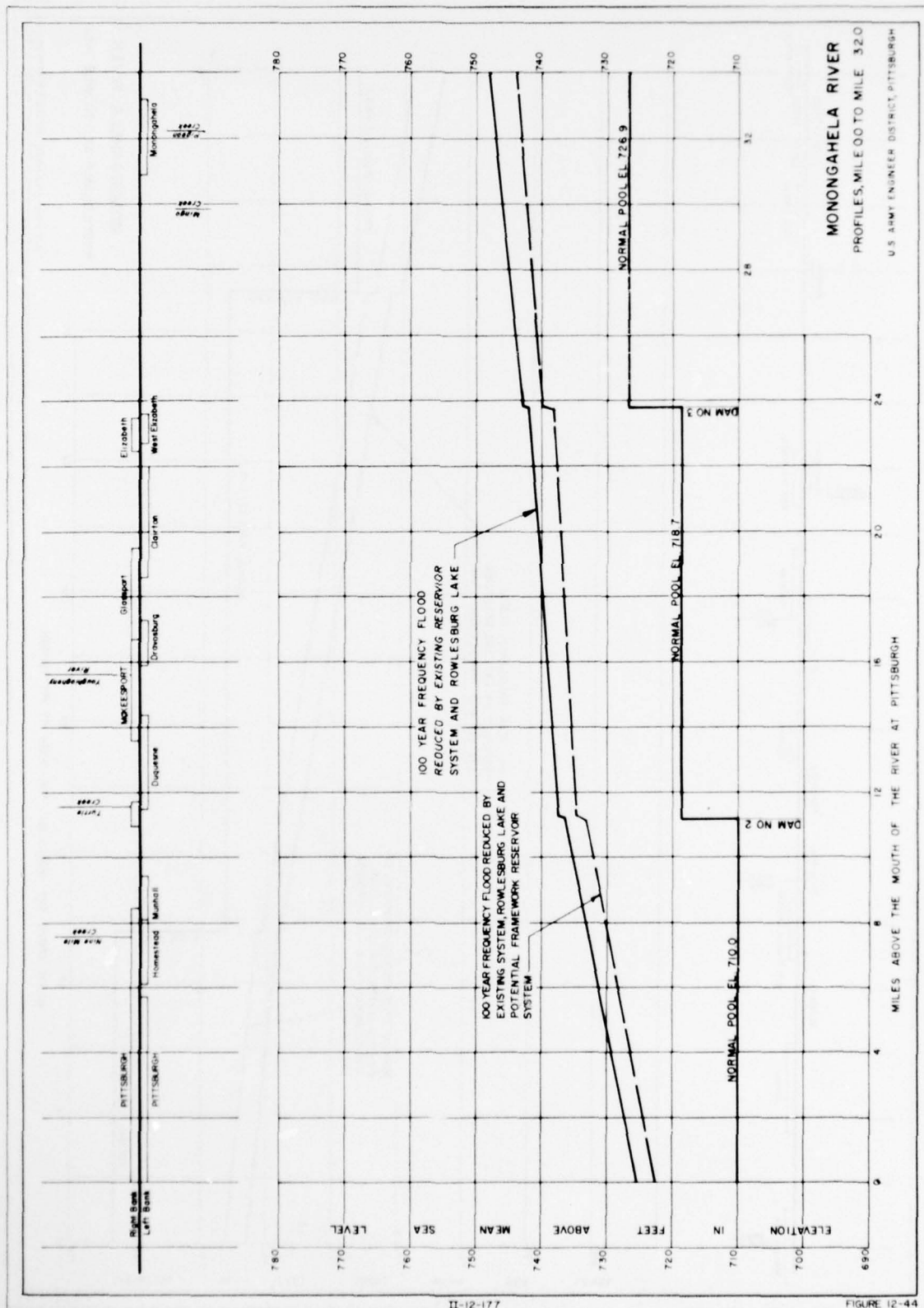
FIGURE 12-39

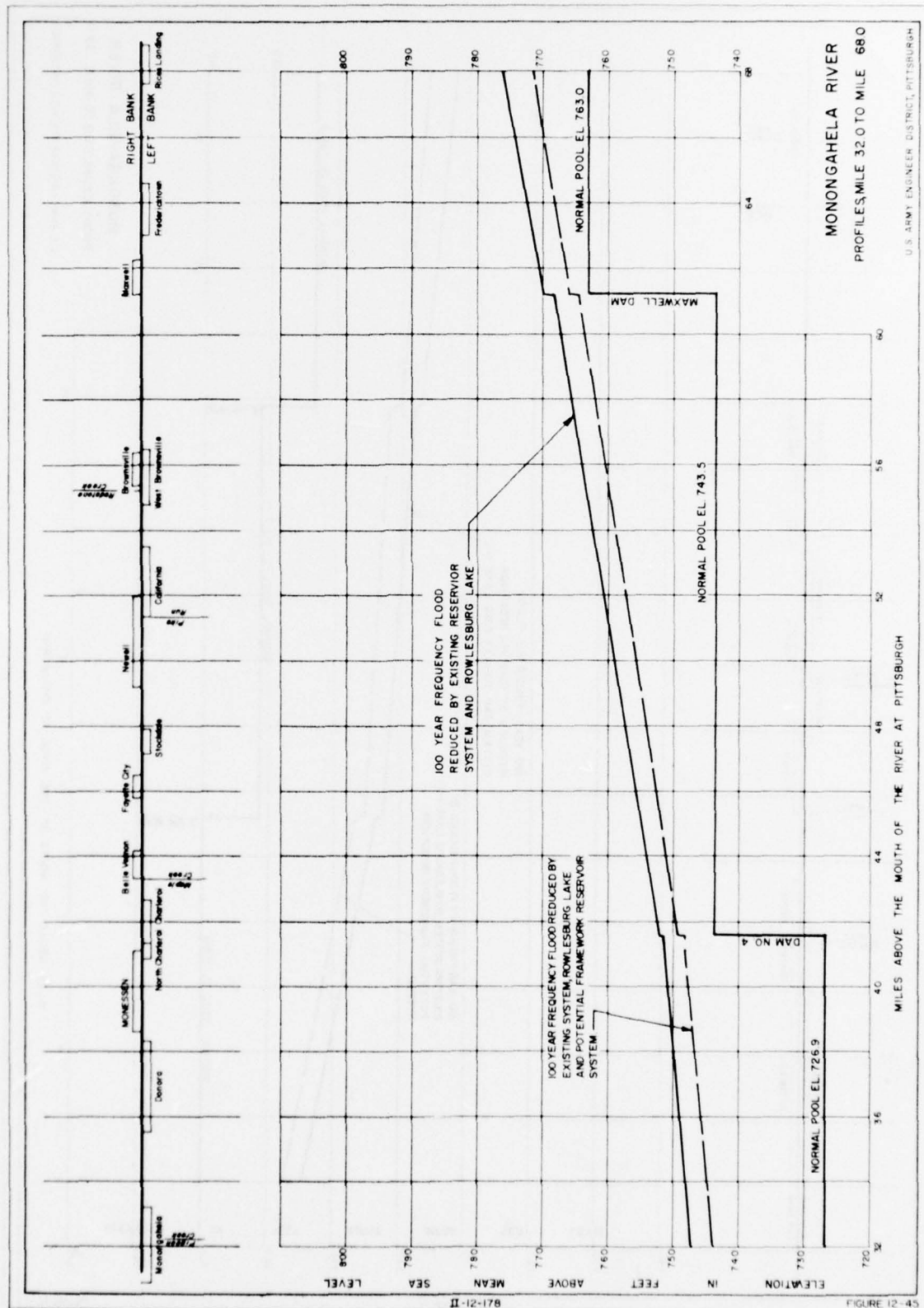


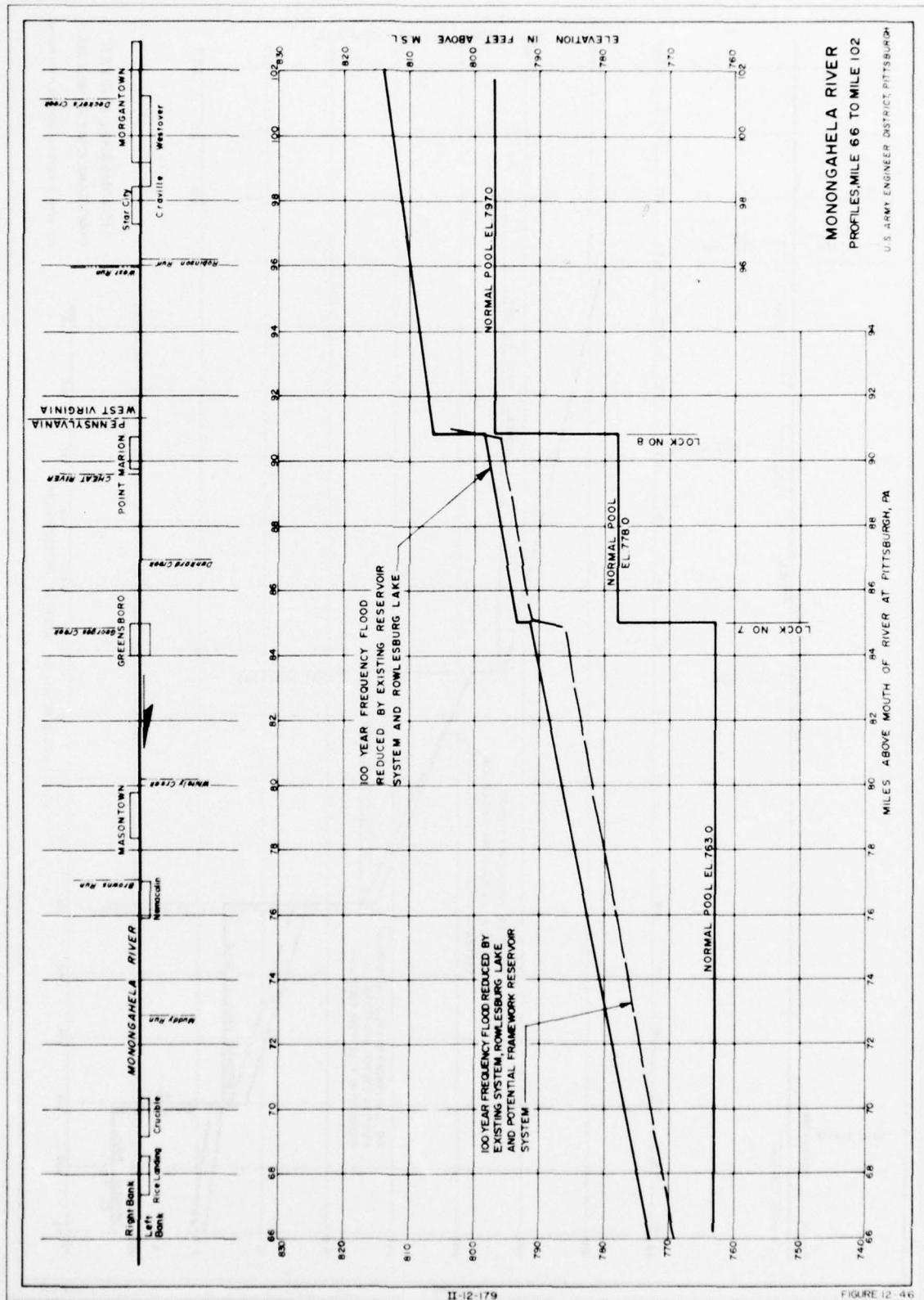


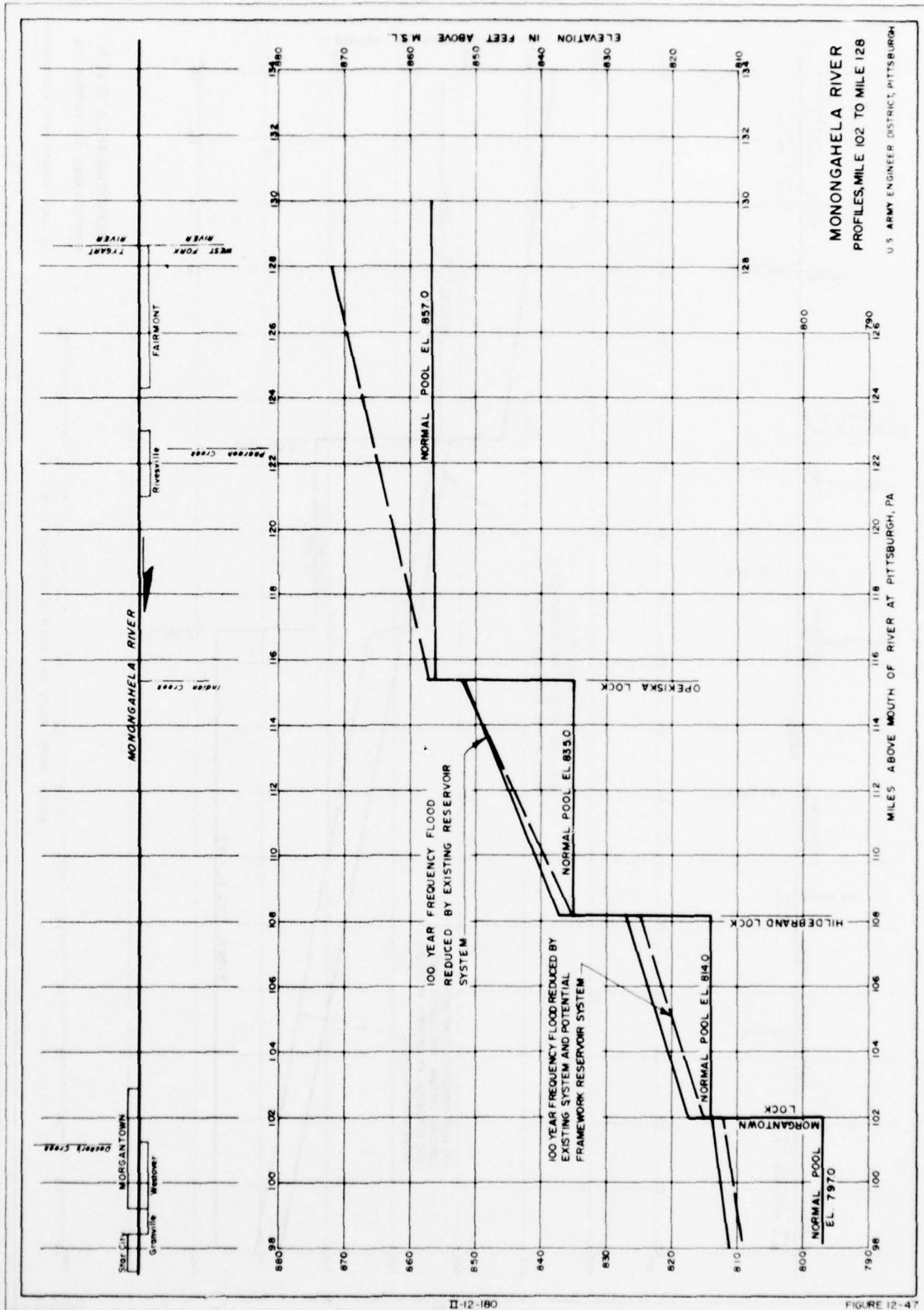












Lake Erie and Lake Ontario (Genesee) Basins */

Subdivision E-1

Entire Cattaraugus Creek Basin.

Gowanda, N. Y. The analyses of water resources needs for Gowanda indicate growth constraining problems of flood damage, lack of water supply, and poor water quality. While present flooding causes annual damages amounting to about \$493,000, major damages can be expected to occur about once in 20 years. Best solutions to these problems, from current studies by the Corps of Engineers, require full water resource development which the most feasible alternative measures have been selected. Local flood protection through Gowanda, and multiple-purpose reservoir projects at the Otto Site in combination with Springville are possibilities for reducing flood damage, providing water supply for irrigation and ensuring water quality flows of about 114 cfs. Two major industries and agricultural interests in the flood plain downstream of Gowanda will benefit from flood protection measures, provision of irrigation water, and ensured water quality flows for assimilation of residual wastes.

Subdivision E-2

Direct Drainage to Lake Erie, excluding Cattaraugus Creek.

Erie-Lake Erie. Growth at the Erie-Lake Erie Regional Growth Center necessitates water goods and services at the individual growth points at Conneautville, Erie and North East in Pennsylvania, and Westfield (Barcelona Harbor) and Dunkirk in New York. Flood damage is not of great significance, except at Conneautville. Conneaut Creek overflow has been studied by the Corps of Engineers, and a feasible improvement appears to be an upstream small earth dam and reservoir, a culvert enlargement, and a culvert improvement with a closure structure. Annual flood damages would be reduced from over \$16,000 by about 13,000 dollars. Flood control storage will require the capacity of the site, leaving little opportunity for development for other uses.

Under study by the Corps of Engineers, refuge harbors at Elk Creek, Walnut Creek, North East, Lake Erie State Park and (the mouth of) Cattaraugus Creek, and commercial port improvements at Erie, Barcelona

*/ See Figure 12-48.

and Dunkirk are expected to remove an impediment to growth along the Pennsylvania shore area of Lake Erie. Favorable locations (shown schematically) exist for refuge harbor facilities for light-draft recreational craft, with which navigation improvements would provide large commercial and general outdoor recreational potential. Pollution of Lake Erie prevents its fullest use for general recreation, sport and commercial fishing, public water supply for developmental and summer resort areas, and other lakeshore use opportunities from Cleveland to Buffalo. Projected water supply requirements can of course be provided by alternative sources from groundwater and new or expanded small reservoirs, if the pollution situation cannot be improved or eliminated soon enough to coincide with developmental needs. Groundwater is abundant throughout this area, but the demand may exceed the dependable yield. Surface storage, therefore, must be considered to induce new industries to the area, and to provide irrigation water to areas along Lake Erie which could be profitably irrigated for better development of unique agricultural assets. Miscellaneous drawbacks in communities such as Westfield, N.Y., could be alleviated by low-flow augmentation. Upstream watershed developments may accomplish this best, and are considered for future study.

Subdivision G-1

Genesee River Basin.

Wellsville, N. Y. Growth constraining problems in the Wellsville area consist of residual annual flood damages of \$24,000, municipal water supply requirements of about 10 mgd, irrigation water needs of about 30 mgd and industrial water supply and quality flows of approximately 95 cfs.

Implementation of the Stannard Reservoir Project,*/ 4 miles above Wellsville upstream on the Genesee River, would reduce flood damages on the order of 70 percent, furnish the needed water supply, irrigation and quality flows, provide considerable outdoor recreation opportunities and create a general environment favorable to economic development.

Other Considerations

As with the preceding basin discussions, the schematic diagrams and best solutions to water resources problems are evaluated for the designated growth centers in the Lake Erie and Genesee River areas. There are other community centers which can expect to experience growth problems related to water resources. The magnitude of these problems may be relatively large and may be associated with growth efforts of the larger centers. Resolution of these problems will be made through coordinated

*/ See Chapter 10, Part III for detailed project analysis.

studies and cooperative efforts of the New York Regional Planning Board for the area, the Pennsylvania Local Development District, the State of New York, the Commonwealth of Pennsylvania, and interested Federal agencies.

Lake Erie and Lake Ontario (Genesee) Basin Plan Components

The plan components in the Lake Erie and Lake Ontario (Genesee River) areas would consist of the following:

Projects in operation or expected to be in place by 1980:

Corps of Engineers

Erie Harbor
Barcelona Harbor
Presque Isle Beach Erosion Control
Dunkirk Harbor
Elk Creek Harbor
Cattaraugus Creek Harbor

Projects for Authorization by 1980:

Stannard Reservoir, Genesee River N.Y. and Pa.

For continued planning:

Corps of Engineers

Small boat harbors at:

Walnut Creek
North East
Lake Erie State Park
Dunkirk

Completion of comprehensive studies of Genesee River Basin and Cattaraugus Creek, and a re-examination of the feasibility of the West Bay Area of Erie Harbor, Pa.

Future Studies

Initiation and continuation of comprehensive basin-type studies of Lake Erie and Lake Ontario (Genesee River) areas with emphasis on lake and tributary water quality, public resort area and industrial water supply, continued study of Lake Erie beach and lakeshore and tributary mouth harbor improvements; and implementation of measures in Genesee River and Cattaraugus Creek Basins.

Basin map and accompanying schematic diagram is shown in Figure 12-48.



LAKE ERIE & GENESEE RIV
 E-1, E-2, G-1

LOCATION MAP

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VICINITY MAP

LEGEND

APPALACHIAN REGION BOUNDARY
WATERSHED BOUNDARY

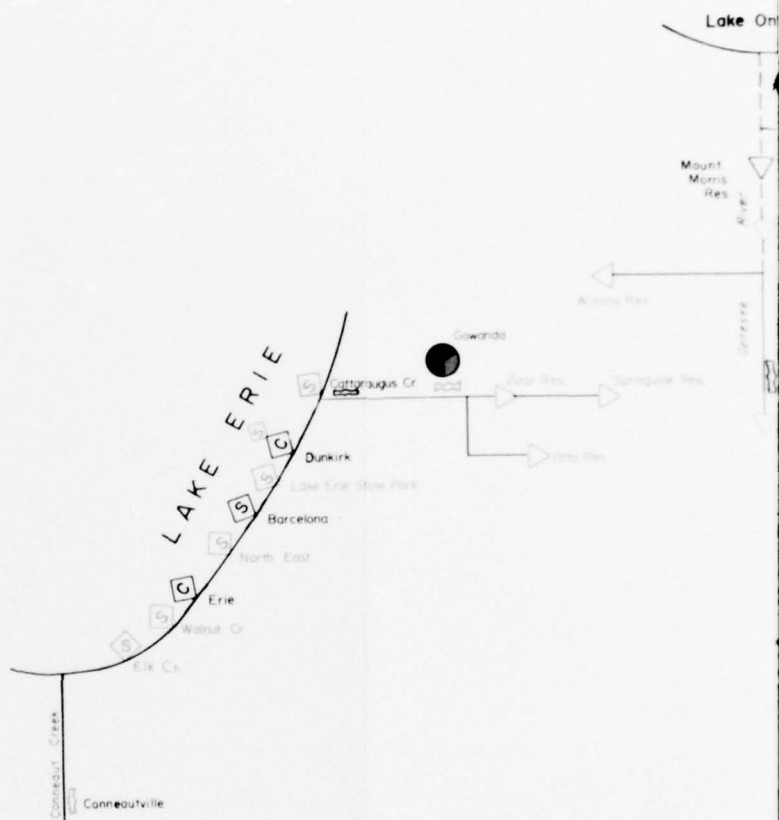
TO EXIST BY 1980

MAJOR RESERVOIR

ALTERNATIVES

MAJOR RESERVOIR

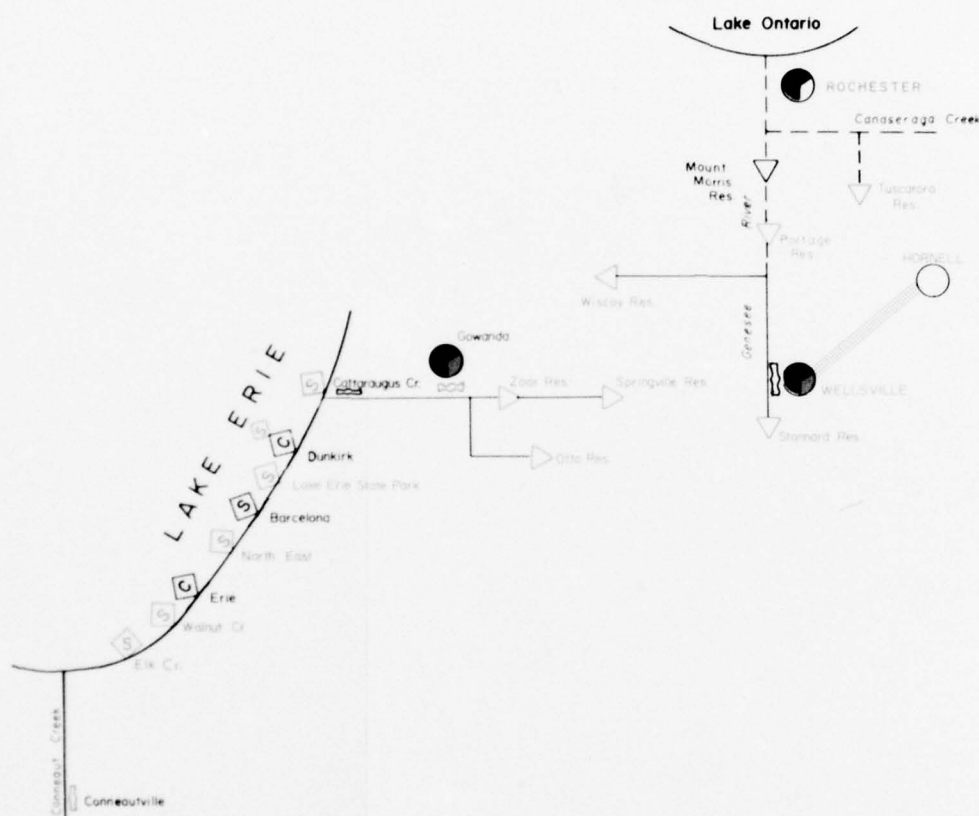
LPP PROJECT



LAKE ERIE & GENESEE RIVER BASIN
E-1, E-2, G-1

LOCATION MAP

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LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980

- △ MAJOR RESERVOIR
- LPP PROJECT

PLANNING ALTERNATIVES

- △ MAJOR RESERVOIR
- LPP PROJECT

OTHER

TOWN NAME PRIMARY GROWTH CENTER
 Town Name SECONDARY GROWTH CENTER

HARBORS

- Ⓢ EXISTING SMALL BOAT
- Ⓢ EXISTING COMMERCIAL
- Ⓢ POTENTIAL SMALL BOAT

LAKE ERIE & GENESEE RIVER BASIN E-1, E-2, G-1 SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

11-12-185

FIGURE 12-48

3

SECTION V - SUB-REGIONAL PLAN

13. RATIONALE OF WATER RESOURCES DEVELOPMENT

Schematically, to year 1980, and then successively to year 2020 (over the next 50-year succession period), respective water resources, needs and developments, have been presented above for each major river basin component of a prospective sub-regional plan. In the aggregate, quantitative water supply, water quality improvement and flood control needs, by 2020, are shown by the schematics.

River basin studies integrated into the system, time phased as presented in Table 12-25 will assure that the secondary areas, as well as the major areas, will have adequate water and related resources for uninhibited development. As mentioned, and shown on the plan, upstream watershed improvements, including the Forest Service Plan shown in Appendices A and F will materially aid the sub-regional plan. The framework of alternative possibilities is envisioned to produce the majority of requirements, except water-based recreation. The tremendous demand for recreation will require rescoping of existing alternatives and furnishing of a higher degree of installation and quality of facilities at the earliest implementation time. No effective objective will be realized by a less conservative approach to recreational planning. The Allegheny and Monongahela National Forests, and the State-developed forests and game lands can be integrated into the total effort, along with development at outstanding wild and scenic river opportunities. Areas like the Conemaugh Gorge, supplemented by a scenic roads and trails system, needs to be evaluated and introduced for early consideration in the plan.

Each state, whose water resources objectives are summarized below, now has an effective systems-development plan in some form of progress and achievement. Integration of state plans by vigorous and well-planned coordination is anticipated as the keystone of plan development and implementation. The gamut of needs and alternatives now under State study is comprehensive and noteworthy, and excellent interest and progress can be anticipated, particularly with aggressive and active interchange of ideas and data. Study groups of various types can be effectively employed to continue the mode of investigation which they have already demonstrated in the sub-region on this and other water and economic surveys.

Various components of this report contain nuclei of ideas and data accumulation, and describe prospective projects and programs, such as those of the USDA. Supplemental data, currently being prepared relative to wild and scenic possibilities, will increase the inventory. The ARC Appalachian Highlands Recreation Study will form an important contribution to the sub-regional plan. It is expected that comprehensive conservation objectives will be incorporated in the plan as more detailed basin studies progress.

Hydroelectric power needs and opportunities in each river basin are discussed in the preceding paragraphs in relation to total electric power requirements for Sub-region F. Comprehensive studies of these are required in the programmed basin studies, much as indicated above and illustrated by potential locations in Table 14 and on Figure 5, Appendix B, Federal Power Commission.

14. FORMULATION METHODOLOGY

In Chapter 11, Part II, and the preceding sections of this subsequent chapter, the most advantageous bases and the major relevant water and related resources deficiencies of the major growth centers of the sub-region for the projected next 50-year economy have been investigated and inventoried, and shown on accompanying schematic diagrams. From these a framework plan, starting with the existing water resource nucleus*/ was derived which relates the preceding schematics and discussions to numerous considerations and developmental factors recommended by the States and participating Federal agencies. Studies conducted by these various agencies**/ indicated that there should be retained in the plan only those potential projects, and existing project modifications, as additions to the existing nucleus which would be apt to aid or produce the most opportune economic developments. These could generally result from satisfaction of water resource needs in areas where large investments are already concentrated. This in essence would at least assure the major growth centers an abundant supply of good quality water, controlled and used to produce the greatest return at least cost; and coincidentally if possible to provide such advantages to secondary and minor growth locations. Consequently, the plan formulation procedure quickly eliminated apparently irrelevant or undesirable project potentials in relation to major growth opportunities, leaving only those in the plan which, with some certainty, would accomplish these objectives.

The plan has been formulated objectively to furnish primarily the largest measure of water damage prevention to induce optimum use of developable sites at the already highly developed growth areas and growth centers along the major rivers and tributary streams which have demonstrated growth characteristics; and at such comparative points having off-stream locations as a direct or an interrelated measure; a maximum supply of a variety of recreational opportunities; a technologically feasible program of pollution abatement, mainly from acid mine drainage; an adequate supply of good quality water; and permissive hydropower developmental measures. The plan has been formulated to realize the maxi-

*/ See description in Chapter 11.

**/ State Water Plans: N.Y. - 28 March 1966
Pa. - 13 May 1969
W. Va. - July 1967

mum physical potential in flood-freeing presently vacant land for industrial use and presently used land for better use, and in reducing residual damages to existing facilities.

Modifications of existing reservoirs, Federal, State and privately-owned, are formulated in a comprehensive manner to produce in the existing base an unrealized additional potential capability for purposes determined relevant to growth. Formulation considerations for modifications encompass water management possibilities, either from completely reformulating individual projects, or rescoping only individual project purposes to remove constraints to development. As for example, determine the best use of an existing reservoir to induce immediately downstream flood plain development by rescoping or operating more specifically for this purpose, or perhaps, if more important, to provide a higher summer recreation pool for maximum recreational use; whichever of these individually, or in combination could have a more essential economic benefit. A vital problem relative to outflow improvement of thermal conditions and mineral acidity at some existing reservoirs would be obtained to some extent by providing structures for selective level withdrawal. The essentiality of pursuing this course of structural and operational modification is illustrated by polluted water outflow conditions at Conemaugh, Loyahanna and East Branch Clarion Reservoirs. These could be improved immeasurably pending satisfactory abatement of the problem, and afterwards obtain the highest water quality condition from thermally and chemically stratified storage. The latter objective has been formulated into the plan to assure that a similar approach could be made at all existing and potential major reservoirs, coordinating the mechanics of selective level withdrawal with downstream quality monitoring by reference to appropriate biological studies.

The need for flood plain planning, occupance and regulation and flood forecasting and other programs to obtain optimum land utilization for economic development are pertinent plan features. Competing and conflicting land utilization problems of the growth centers can be resolved by effective use of this part of the plan. A further plan feature contemplated involves extension of Federal-state river forecasting service on a systems basis to interrelate plan operational data dissemination with economic growth by augmenting the potential for flood-freeing of developable land.

Formulation of the part of the plan to deal with the acid mine drainage pollution problem, which has infested the sub-region through all of its water resources, is a sensitive social, political and economic area because the problem is outstripping activities to reduce its detrimental effects on the projected economy. Serious present efforts^{*/} are progressing to eradicate the problem with attacks on the chemical, physical, biological and bacteriological and other fronts. Numerous temporary

^{*/} For example, the Commonwealth of Pennsylvania Ten Year Program.

and permanent-type advances have been made toward implementation of a necessary, aggressive, program to permanently remove this constraint to development. An essential part of this plan is not for total abatement of the problem, but to some extent the suggested approach offered by Appendix D relating to the Water Supply and Quality Study for the potential St. Petersburg Reservoir project,^{*/} and a similar study made for the potential Raccoon Creek Reservoir project - both essentially critical first-phase elements - to institute feasible abatement measures on the least costly basis at the major sources of the pollution, using present scientific capability. In regard to the latter, objectives currently being achieved at Morrainne State Park by the Commonwealth of Pennsylvania are noteworthy and deserving of emulation.

In view of the exceptionally large demand for recreational development, (the greatest in Appalachia) the plan has received particular attention in its formulation to obtain the maximum satisfaction in areas which are ideally suited for recreational development of all types. These include emphasis on large-scale opportunities which lend themselves to public and private investments; in areas where tourism and extended vacation use is more vital; and in areas where variable needs commensurate with scenic and unique possibilities would indicate developmental potential. Environmental enhancement in the vicinity of the growth centers, is an important formulation element for those underdeveloped counties which possess a paucity of industrial possibilities, and consequently are more dependent upon exploitation and improvement of the environment to attract additional development.

15. SUB-REGIONAL PLAN

The plan is composed of projects and program measures, organized into a comprehensive framework to meet existing, projected and potential needs determined by coordinated investigation and research programs. The plan components and elements are located and scoped in response to definite interrelated water area demands. These have been shown by the states to be discernibly related to their programs of economic growth and development. The most urgent plan features required for the near future to bolster the existing economy or to obtain stimulative economic effects to initiate the projected economy are designated in the plan for first-phase consideration.

End points for projections at years 1980, 2000 and 2020 established developmental levels for the plan and time phasing to meet these levels insofar as practicable. Needs and probable satisfactions correlate the manner by which the necessary plan elements and opportunities are time-

^{*/} See also Chapter 11 of Part III, St. Petersburg Project Analysis.

phased into the first and later plan phases. The plan is accordingly commensurate with the projected economic development phasing, and provides sustaining and stimulating features to the extent that these can be derived from the availability of good quality water and related resources which may influence primarily the future locations of industry.

Plan Objectives

The plan presents a framework (or system) of water resource needs satisfactions to provide comprehensive development of the sub-region's resources and to eliminate or ameliorate its major problems as viewed by the participating states under their water and economic development policies. The states' policies and requirements for the plan are briefly stated herein with regard to the realization of developmental objectives for their growth centers in the three water areas of the sub-region. The comprehensive water resource capability of the plan relates its potential to the carefully judged set of developmental possibilities for each of the water areas presented in Section I. Accordingly, the plan encompasses each of the states' Appalachian plan features as elements, coordinated and expanded into a unified, harmonious entity to assure orderly development through joint action, such that each water area will make properly scaled water and related resources contributions to meet the sub-region's needs.

Pennsylvania; Water Areas F-1 and F-2:

The Commonwealth of Pennsylvania supported portion of the plan consists of projects and programs unanimously recommended by its three Local Development Districts in the sub-region to involve the functions of flood control, recreation development, recreation enhancement, water supply, water quality, conservation and wildlife, port improvement, land restoration and reclamation, and education. These elements of the sub-region plan represent a condensation of the State's more comprehensive proposals obtained from the Local Development Districts, and their constituent county planning commissions. The scope of the varied Pennsylvania plan contributions, screened from more than 200 local project needs, covers the broad aspects of its economic potential, mainly requiring investments in multiple-purpose major reservoirs and upstream watershed management and protection programs, mine drainage abatement (a principal purpose), tourism and developmental areas for recreation as an industry, and navigation improvements. Priority projects which the State placed in its recommended and study categories are those for which it needs accelerated authorization for early implementation. It also needs funding and financial assistance to accelerate these projects.

New York; Water Area F-1:

Reliance by the State of New York in its contribution to the plan is placed primarily on broad programs of multi-purpose water resources development, particularly reservoirs in Water Area F-1 which can stimulate economic activity through environmental enhancement to

provide an inducement to attract private enterprise; and, secondarily, on its plan elements which will adequately furnish agricultural and industrial water needs, and flood protection of stream valleys exhibiting industrial growth potentials, and will generally also provide stimulation by improvement of recreation possibilities strongly dependent upon the natural environment. In scope, New York project requirements in the plan relate to the potentials of definitely defined growth area and growth centers, and project and program needs to development of a host of specific industrial sites and economic opportunities. Consequently, it is considered that New York elements in the plan are both broad-area based - relating to its own Appalachian counties as well as those in adjacent Pennsylvania; and locally based - relating to specific internal points along its tributaries to the Allegheny Basin, Lake Erie and Lake Ontario. The New York plan potentials are effectively correlated between its Regional Board studies for water resources planning and comparative Department of Commerce and local industrial development group growth area analyses and industrial site surveys.

West Virginia; Water Area F-3:

A strong developmental framework for the Ohio and Monongahela Basin sectors in Water Area F-3 forms a significant part of the plan contributed by the State of West Virginia, based upon the needs and opportunities of its water-using and water-oriented industries. The West Virginia plan components are concentrated on first-phase elements for more broadly developing its growth areas (regions), with later-phase dependence on improvements for specific growth centers. The State's objectives call for overall development of its varied water and related resource potentials on a systems basis, to reflect its future need for more comprehensive, integrated developments by which it can enhance the existing water resource base, particularly where its plan elements are better financially suited to extensive development of a few broad water recreational complexes, with fish and wildlife improvements well represented; and of industrial sites along its Ohio and Monongahela River sectors, and along the latter's large headwater tributaries, enhancing opportunities by removing detriments to growth remaining from past private and municipal activities, especially pollution.

Ohio; Water Area F-3:

The State of Ohio's part of the plan is centered on industrial developmental possibilities in its portion of the sub-region along the main stem Ohio River, located in Water Area F-3. With this Ohio area being contiguous with the Steubenville-Weirton and Wheeling, West Virginia, SMSA's, its plan components are likewise associated with goods and services from upstream first-phase major reservoir developments to enhance its industrial sites in Belmont and Jefferson Counties. In scope, Ohio's plan involvements relate water damage prevention and comprehensive flood-plain management as major elements in the plan.

Plan Phasing

The components of the plan are intended to provide the most effective way to obtain concurrent satisfaction of the major individual water area and sub-region needs, over the time period to year 2020. Accordingly, the proposed scheduling of the plan follows, concentrating on providing the means for (1) flood-freeing developable lands, (2) abating pollution problems, (3) enhancing the environment, (4) furnishing water supply to growth centers, (5) developing a complex of recreational possibilities, and (6) water power; with summaries of residual present and future needs, to correlate the entire program.

The first-phase of the plan to be accomplished by 1990 contemplates principally that (1) construction and study programs will progress consistently on the main items for accomplishing these objectives, with major emphasis on those of sub-region-wide benefit for water damage prevention, particularly major reservoirs and their associated multiple-purpose possibilities for recreation and environmental enhancement, and other purposes, to support and induce economic development; (2) an accompanying comprehensive upstream watershed program will be developed in the first-phase, consistent with desires by the states and local interests to accomplish similar purposes in the headwater and other areas more amenable to smaller reservoirs and associated developments; (3) construction and study programs will progress in timely fashion on pollution abatement programs, principally those designated for priority by the states, especially in tributary and main stream areas where high water quality is basic to developments in (1) and (2); and (4) construction and study of the other elements of the plan involving modifications of projects in the existing water and related resource base. The group of major projects and programs selected are those which would provide a significant reduction in residual needs in the individual water areas and in the sub-region by 1990, and combined with the existing nucleus would be the means for progressively further reducing residual needs so that as the projected development is realized the planned water and related resources will be available when needed for supporting and inducing continuing growth at the rate desired to 2020.

Generalized Plan

There are two most essential plan elements for coordinated, integrated, sub-regional study-construction phasing over the implementation period to year 2020 to provide the most efficient and least costly development of the land and water resources: namely, a set of comprehensive sub-regional basin studies to encompass all considerations pertinent to economic and related water resources; and a broad and effective study, and early implementation program of pollution abatement and control measures, particularly for mine drainage, with the proviso that sufficient financial assistance can be provided to sustain such a program. The individual alternative elements of the plan, and their effectiveness, except for the potential St. Petersburg and Stannard

Reservoir projects (which are reported on in survey scope in Part III, Chapters 11 and 10 respectively), have not been studied in sufficient detail to determine economic and structural feasibility. Accordingly, it is necessary that the overall generalized plan elements for study and construction be concurrently carried forward along with coordination of Federal and non-Federal responsibilities.

Definition and possibly legislative modifications relating to the latter may be required to make the plan implementation consistent with the financial abilities of the non-Federal interests. This generally appears to be the soundest approach to development of the sub-region's water resources particularly for their role in the projected economy as stimulative or catalytic measures.

Detailed Plan

The several water areas have immediate requirements to expeditiously set the stage for expanding opportunities. Since it was not possible to develop detailed information on all areas in the sub-region, and institutional arrangements for spurring development could emanate from this water resource survey, it becomes necessary that there be a method for reinspection of the need and sequencing the location of future studies to best serve the sub-region in producing the required water and related resources for economic development. This will minimize the foregoing of production of currently needed water resources, while at the same time minimizing current development of those resources for which the need will not exist for some time in the future.

Also, this study has indicated that in an overall program of public investments for economic development under the Appalachian Act there exists an immediate need for development of the water and related resources potential of the Clarion River in Pennsylvania (St. Petersburg Reservoir Project) and also Stannard Reservoir Project, and for accompanying future studies on major river basins in the sub-region from which specific (interim) projects can be selected for accelerated construction to meet state and local development needs. To accomplish these objectives and those of the Act, in relation to sequencing public investments, these future studies would appear to require initiation as early as possible and continuation until the interim projects are implemented, and the groundwork prepared for later plan phasing. The projected elements which are of major importance are shown with their time phasing for study and construction in the detailed plan which follows in Table 12-25.

The Plan reflects a large degree of implementation in the first-phase. This is based upon present knowledge of needs and the potential use of various plan components to achieve economic development objectives, coupled with the States' recommendations for projects deemed necessary for their economic development strategies and water resources

plans and policies. The latter consideration is important relative to the objectives of the Appalachian Act. Consequently, the detailed plan elements are distributed between the participating states in the water areas of the sub-region (and extended into Sub-regions B and G for intrabasin purposes) to enhance the developmental opportunities of the growth centers as desired by the states.

The Plan provides an effective and flexible vehicle by which detailed interim project and program studies can be extracted in a responsive manner to needs and expedited implementation requirements via a blanket set of Basin Studies and a special purpose Pollution Study. It offers in this way the possibilities to accomplish the objectives of the projected economy on a sub-regional basis, to serve water area and local needs, and to make Plan adjustments as circumstances and planning concepts dictate at the time of detailed study.

Storage works are the predominating feature of the Plan, providing about 6 million gross acre-feet of reservoir storage which can be used in the predetermined allocations or which can be otherwise subdivided in various systemized ways on the basis of more detailed studies. The allocations based on present knowledge provides about 2.3 million acre-feet for water damage prevention needs, and about 3.4 million acre-feet for conservation needs. Qualifying restrictions on drawdown of storage volume provides for comprehensive economic development of downstream areas and retention of optimum recreation pool levels, and controls on water withdrawals to obtain maximum selectivity for water quality purposes. The Plan features shown in Table 12-25 and on Figure 12-50 for optimized facilities for economic development in the upstream watershed areas for water damage prevention, land treatment, etc., advanced in the 10-year USDA Program would be effective to the extent shown in the tabulation. Later-phase development and more definite first-phase implementation requirements of the USDA Program would be based upon the overall basin studies and programs, coordinated with that agency.

Present indications^{*/} are that water supply for municipal and industrial needs is not a most vital or basic requirement for storage, assuming adequate and timely institution of treatment measures, controls and advanced technology; the Plan, nevertheless, retains the built-in possibility that as more detailed studies are made of local needs for economic development, progress in these highly specialized and rather expensive technical areas may not be a firm enough assumption upon which to conjecture that these advancements will meet needs satisfactions.

In addition to meeting other most urgent conservation needs of the Sub-region, the U. S. Department of Agriculture recommends acceleration of land treatment and management programs for privately owned and National Forest lands. This acceleration will provide continued production of food

^{*/} FWPCA.

and fiber and reduction of floodwater, erosion, and sediment damages. It will also increase outdoor recreational opportunities and improve the water and environmental quality of the sub-region. Priority will be given to critically eroding areas and the drainage areas above the recommended and existing water resource developments of the states, Corps of Engineers and others to improve their efficiency and useful life. The acceleration required is as follows:

1. Adequately treat and protect 115,800 acres of cropland, improve 211,900 acres of pasture and establish 29,900 acres of new pasture planting.
2. Revegetate and stabilize critically eroding areas on 6,490 acres of roadbank and 108,380 acres of surfaced mined areas.
3. Increase recreational and fish and wildlife opportunities by the construction of 325 farm ponds, management of 1,160 farm ponds for fish production, construction of 103 miles of recreation access roads, development of 20,300 acres of wildlife habitat, plan for wildlife habitat preservation of 113,790 acres, and develop 6,360 acres for picnic areas and 2,540 acres for camping areas.
4. Develop 12,840 basic conservation plans and complete detailed soil surveys on 1,570,320 acres.

Acceleration for state and private forest and woodland includes:

1. Plant 33,240 acres in trees.
2. Treat 540 acres for erosion control.
3. Treat 31,070 acres for hydrologic stand improvement, 20,080 acres of harvest cutting, and protect 35,500 acres from livestock grazing.
4. Develop 1,999 forest and woodland management plans.

Planned acceleration for National Forests is as follows:

Tree Planting	Acres	17,000
Timber Stand Improvement	Acres	37,200
Water Yield:		
Improvement by Vegetative Management	Acres	20,000
Soil and Water:		
Gully Stabilization	Acres	10
Sheet Erosion Control	Acres	300
Streambank Stabilization	Acres	60
Stream Channel Clearing	Acres	10
Rehab. Abandoned Roads & Trails	Acres	80
Mined Area Stabilization	Acres	10
Pollution Abatement	Acres	880

Soil Survey	Acres	700,000
Watershed Analysis	Acres	300,000
Fish and Wildlife:		
Big Game Range Analysis	Acres	454,500
Small Game Range Analysis	Acres	85,000
Wildlife Openings	Acres	16,300
Seeding and Planting	Acres	7,500
Planting Waterfowl Food Plants	Acres	400
Stream and Lake Surveys	Acres	300

The structural measures include: Construction of (a) one Fire Weather Station, (b) one Lookout Tower, (c) 710 acres of waterholes for wildlife and impoundments and potholes for waterfowl, (d) 1,950 acres of impoundments for recreation, (e) 1,300 acres of developments and two special projects for recreation, (f) 400 acres of roadside developments, (g) 800 miles of road, (h) 27 observation sites, and (i) 100 bridges; improvement of 1,600 acres of stream and lake habitat for fish and wildlife; and acquisition of 128,300 acres of land.

Adequacy of Plan

Water Damage Prevention. The most significant water damage problem areas are indicated to be mainly concentrated in the major river basins, particularly the middle-lower Monongahela River, the lower Allegheny, the Ohio River and also in the Lake Erie Drainage area. The Framework Study was developed in such a manner that the potential projects contained therein would reduce the water damage of as many of the major problem areas as possible.

The potential reservoirs contained in the Allegheny, Monongahela, Beaver and Upper Ohio River Basin portions of the Framework Study would provide for the control of more than 5,000 additional square miles of the drainage area and an additional flood control storage in excess of 1.8 million acre-feet of water. These reservoirs would reduce the average annual principal stream reach flood damages from \$3,852,000 to \$1,890,300 or a total average annual reduction of \$1,962,100 based on present conditions. (See Table 12-26.) They would also effect a flood reduction of approximately 5 feet on the Ohio River based on the 100-year flood.

This reduction would make extensive areas of potentially developable industrial land along the major rivers of the sub-region flood free or at least reduce the frequency of flooding to the point where the damage is negligible.

The average annual flood damages that will exist after completion of the reservoir projects under construction (Union City and Muddy Creek) and those in preconstruction planning (Rowlesburg, Stonewall Jackson and Woodcock Creek) are given for the major basins which drain into the Ohio River in Table 12-26 which follows. Average annual flood damage prevention would be provided by the potential 37 reservoir system has been estimated for each of the principal stream reach districts in the Allegheny, Monongahela, Beaver and Ohio River Basins. (See Table 12-27.)

Water Supply and Water Quality. The Framework Study in combination with the plan developed by the United States Department of Agriculture (SCS) has both the storage capacity and flexibility of operation necessary to satisfy the projected water supply and water quality needs for Sub-region F. Table 12-28 shows the amount of supplemental storage which is available in each of the potential reservoirs included in the Framework Study. The flexibility of these reservoirs is indicated by the fact that this supplemental storage has not been definitely designated for any one particular use at the present time, but can be used for any number of uses which might develop in the sub-region based on further investigation of future water resource problems and needs as they develop, such as water supply, water quality, power or recreation. At a later date when the plans for each of these reservoirs is being more definitely formulated, the needs will be re-evaluated and the supplemental storage can be more definitely allocated to a specific purpose. Consequently, no definite attempt has been made to do this at the present time, as the needs are constantly changing and an infinite number of alternatives and combinations of uses for the storage contained in these reservoirs both singly and in combination is possible to satisfy these needs within the scope of the Framework Study. Another pertinent constraint on framework formulation, acid mine drainage pollution, will hopefully be materially reduced in the near future as envisioned by the planned measures shown in Table 12-25.

TABLE 12-25

ELEMENTS
OF
BASIN CONCEPT PLAN
FOR
CONSTRUCTION-STUDY PROGRAM

<u>RESERVOIRS</u>	<u>WATERSHED PROJECTS</u>	<u>LOCAL PROTECTION PROJECTS</u>	<u>NAVIGATION PROJECTS</u>
TIME PERIOD 1970 - 1980			
<u>STUDIES</u>			
1. Basin Studies* For:	1. Preparation of Work Plans For:	1. Project Reports and Advanced Engineering and Design For:	1. Engineering and Design Modernization of Navigation System.
a. Genesee River **	a. Blacklick Creek, Pa.	a. Lake Chautauqua - Chadakoin River	a. Elizabeth Lock & Dam, Monongahela River
b. Monongahela River	b. Connoquenessing Creek, Pa. 1/	b. Gowanda	b. Montgomery Lock & Dam, Ohio River
c. Allegheny River	c. Sewickley Creek, Pa.	c. New Castle, Pa.	c. Dredging of Erie River
d. Beaver River	d. Upper French Creek, Pa.	d. Millvale, Pa.	
e. Upper Ohio River	e. Elk Creek, W. Va.	e. Uniontown, Pa.	
f. Susquehanna River **	f. Kings Creek, W. Va.	f. Connellsville, Pa.	
2. Advanced Engineering Studies For:	g. Limestone Run, W. Va.	g. Connoquenessing Creek, Pa. 1/	
a. St. Petersburg and Stannard Reservoirs	h. Prickett Creek, W. Va.	h. Johnstown, Pa., Stony Creek & Sams Run.	
3. Project Studies of Interim Projects from Basin Studies For:	i. Simpson Creek, W. Va.	i. West Fork River, below Clarksburg, W. Va.	
a. Water Damage Prevention	j. Three Fork Creek, W. Va.	2. Studies on possible modification or extension of Existing Projects.	
b. Water Quality	k. Upper Middle Island Creek, W. Va.		
c. Water Supply			
d. Recreation			
e. Economic Development			
4. Project Studies (Survey Scope) For Reservoir Projects:			
Big Sandy Cr., Dunkard Cr., Laurel Hill Cr., Upper Casselman R., Raccoon Cr., Upper Tygart R., Middle Fork R., Buckhannon R., Cattaraugus Cr. (Otto & Springville Sites), Cassadaga Cr., Stillwater Cr., & Upper Conewango Cr.			
5. Studies on possible modification of Existing Projects.			
<u>CONSTRUCTION</u>			
1. Rowlesburg	1. Short Creek, Ohio	1. Chartiers Creek, Pa.	1. Hannibal Lock & Dam, Ohio River
2. Stonewall Jackson	2. Jacobs Creek, Pa.	2. DuBois, Pa.	2. Grays Landing, Mon. Riv
3. Union City	3. Stonecoal Creek, W. Va.	3. Salamanca, N. Y.	3. Point Marion, Mon. Riv
4. Muddy Creek	4. Ten Mile Creek, W. Va.		
5. Woodcock Creek			

COMPLETION OF NUCLEUS PLAN

- * Applies to all projects and programs
** Continuation of going study

1/ Alternative or Joint Project

TABLE 12-25

ELEMENTS
OF
BASIN CONCEPT PLAN
FOR
CONSTRUCTION-STUDY PROGRAM

NS	NAVIGATION PROJECTS	RECREATION	POLLUTION ABATEMENT PROGRAM	FLOOD PLAIN REGULATION PROGRAM
used for: adoption	<ol style="list-style-type: none"> 1. Engineering and Design for Modernization of Navigation System. <ol style="list-style-type: none"> a. Elizabeth Lock & Dam, Monongahela River b. Montgomery Lock & Dam, Ohio River c. Dredging of Erie Harbor 	<ol style="list-style-type: none"> 1. Studies pertinent to "Recreation as an industry," and Appalachian Highlands Study. 2. Restructuring of recreation master plans in relation to modifications to Existing Reservoirs. 3. Studies relating to Environmental Enhancement. <ol style="list-style-type: none"> a. Strip Mine Reclamation b. Scenic Easements 	<ol style="list-style-type: none"> 1. Source Investigations and Engineering Studies of Mine Drainage Problem Areas Relative to Basin Studies. 2. Investigation of all types of pollution. 3. Pennsylvania's Ten-Year Mine Drainage Pollution Abatement Program. 	<ol style="list-style-type: none"> 1. Flood Plain Mgt. Studies with "HIGHEST AND BEST USE" of land prime consideration.
k, Pa. 1/ y Creek &				
ow				
ification or jects.				
	<ol style="list-style-type: none"> 1. Hannibal Lock & Dam, Ohio River 2. Grays Landing, Mon. River 3. Point Marion, Mon. River 	<ol style="list-style-type: none"> 1. Otocsin 2. Small Boat Harbors <ol style="list-style-type: none"> a. Elk Creek, Pa. b. Lake Erie State Park, N.Y. c. Cattaraugus Creek, N.Y. d. Dunkirk, N.Y. 	<ol style="list-style-type: none"> 1. Acid Abatement <ol style="list-style-type: none"> a. Clarion River b. West Branch Susquehanna River c. Casselman River d. Raccoon Creek 2. Pollution Control <ol style="list-style-type: none"> a. Lake Chautauqua 	

COMPLETION OF NUCLEUS PLAN

2

TABLE 12-25
ELEMENTS
OF
BASIN CONCEPT PLAN
FOR
CONSTRUCTION-STUDY PROGRAM
(CONTINUED)

RESERVOIRS	WATERSHED PROJECTS	LOCAL PROTECTION PROJECTS	NAVIGATION
TIME PERIOD 1980 - 1985			
<u>STUDIES</u>			
1. Advanced Engineering and Design Of:	1. Preparation of Work Plans For:	1. Advanced Engineering and Design Of:	1. Engineering and Design For:
a. Big Sandy Creek	a. Great Valley Creek, N. Y.	a. Allegany, N. Y.	a. Aspinwall Lock, Allegheny River
b. Dunkard Creek	b. Little Valley Creek, N. Y.	b. Russell, Pa.	b. Charleroi Lock, Monongahela River
c. Laurel Hill Creek	c. Brokenstraw Creek, Pa.	c. Franklin, Pa.	c. Emsworth Lock, Ohio River
d. Upper Casselman River	d. Indian Creek, Pa.	d. Conneautville, Pa.	
e. Raccoon Creek	e. LeBoeuf Creek, Pa.	e. Ford City, Pa.	
f. Upper Tygart River	f. Mahoning Creek, Pa.	f. Ligonier, Pa.	
g. Middle Fork River	g. Oswego Creek, Pa.	g. Etna, Pa.	
h. Buckhannon River	h. Potato Creek, Pa.	h. Sharpsburg, Pa.	
i. Stillwater Cr.	i. Raccoon Creek, Pa.	i. Tarentum, Pa.	
j. Cassadaga Cr.	j. Sandy Lick Creek, Pa.	j. Oakdale, Pa.	
k. Upper Conewango Cr.	k. Sugar Creek, Pa.	k. Burgettstown, Pa.	
2. Continuation of Basin Studies	l. Tionesta Creek, Pa.	l. Wallace, W. Va.	
3. Continuation of Studies of Modification of Existing Projects	m. Turtle Creek, Pa.	m. Parsons, W. Va.	
	n. Upper Allegheny River, Pa.	n. Morgantown, W. Va.	
	o. Upper Loyalhanna Creek, Pa.		
	p. West Branch Clarion River, Pa.		
	q. Paw Paw Creek, W. Va.		
	r. Sandy Creek, W. Va.		
<hr/>			
<u>CONSTRUCTION</u>			
1. St. Petersburg & Stannard Res.	1. Blacklick Creek, Pa.	1. Lake Chautauqua - Chadakoin River	1. Elizabeth Lock, Monongahela River
2. Possible Interim Projects from Basin Studies.	2. Connoquenessing Creek, Pa.	2. Gowanda, N.Y.	2. Montgomery Lock, Ohio River
3. Possible Modification of Existing Projects	3. Sewickley Creek, Pa.	3. New Castle, Pa.	3. Dredging of Erie (including West)
4. Cattaraugus Cr. (Otto Reservoir)	4. Upper French Creek, Pa.	4. Millvale, Pa.	
	5. Elk Creek, W. Va.	5. Uniontown, Pa.	
	6. Limestone Run, W. Va.	6. Connellsville, Pa.	
	7. Kings Creek, W. Va.	7. Connoquenessing Creek, Pa.	
	8. Prickett Creek, W. Va.	8. Possible Modification of Existing Projects.	
	9. Simpson Creek, W. Va.		
	10. Three Fork Creek, W. Va.		
	11. Upper Middle Island Creek, W. Va.		

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TABLE 12-25

ELEMENTS
OF
BASIN CONCEPT PLAN
FOR
CONSTRUCTION-STUDY PROGRAM
(CONTINUED)

PROJECTS	NAVIGATION PROJECTS	RECREATION	POLLUTION ABATEMENT PROGRAM	FLOOD PLAIN REGULATION PROGRAM
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and Design Of:	1. Engineering and Design Studies For: a. Aspinwall Lock and Dam, Allegheny River b. Charleroi Lock and Dam, Monongahela River c. Emsworth Lock and Dam, Ohio River	1. Continuation of Recreation Studies	1. Continuation of Pollution Studies	1. Continuation of Flood Plain Mgt. Studies
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1. Elizabeth Lock and Dam, Monongahela River
2. Montgomery Lock and Dam, Ohio River
3. Dredging of Erie Harbor (including West Bay)

1. Small Boat Harbors
 - a. North East, Pa.
 - b. Walnut Cr., Pa.

Mine drainage programs as indicated by studies.

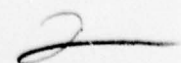


TABLE 12-25
ELEMENTS
OF
BASIN CONCEPT PLAN
FOR
CONSTRUCTION-STUDY PROGRAM
(CONTINUED)

<u>RESERVOIRS</u>	<u>WATERSHED PROJECTS</u>	<u>LOCAL PROTECTION PROJECTS</u>	<u>NAVIGATION</u>
TIME PERIOD 1985 - 1990			
<u>STUDIES</u>			
1. Complete Basin Studies during this time period	Continue Studies of Watersheds and Preparation of Work Plans for projects determined necessary.	Continue Study of areas needing local protection.	Continue Study for of Navigation Sys
2. Advanced Engineering and Design of needed projects			
<hr/>			
<u>CONSTRUCTION</u>			
1. Big Sandy Creek	1. Great Valley Creek, N. Y.	1. Allegany, N. Y.	1. Aspinwall Lock and Allegheny River
2. Dunkard Creek	2. Little Valley Creek, N. Y.	2. Russell, Pa.	2. Charleoi Lock and Monongahela River
3. Laurel Hill Creek	3. Brokenstraw Creek, Pa.	3. Franklin, Pa.	3. Emsworth Lock and Ohio River
4. Upper Casselman River	4. Indian Creek, Pa.	4. Conneautville, Pa.	
5. Raccoon Creek	5. LeBoeuf Creek, Pa.	5. Ford City, Pa.	
6. Cattaraugus Cr. (Springville Res.)	6. Mahoning Creek, Pa.	6. Ligonier, Pa.	
7. Upper Tygart River	7. Oswago Creek, Pa.	7. Etna, Pa.	
8. Middle Fork River	8. Potato Creek, Pa.	8. Sharpsburg, Pa.	
9. Buckhannon River	9. Raccoon Creek, Pa.	9. Tarentum, Pa.	
10. Stillwater Cr.	10. Sandy Lick Creek, Pa.	10. Oakdale, Pa.	
11. Cassadaga Cr.	11. Sugar Creek, Pa.	11. Burgettstown, Pa.	
12. Conewango Cr.	12. Tionesta Creek, Pa.	12. Wallace, W. Va.	
13. Additional interim projects from Basin Studies	13. Turtle Creek, Pa.	13. Parsons, W. Va.	
	14. Upper Allegheny River, Pa.	14. Morgantown, W. Va.	
	15. Upper Loyalhanna Creek, Pa.		
	16. West Branch Clarion River, Pa.		
	17. Paw Paw Creek, W. Va.		
	18. Sandy Creek, W. Va.		

COMPLETION OF 1st PHASE

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TABLE 12-25
ELEMENTS
OF
BASIN CONCEPT PLAN
FOR
CONSTRUCTION-STUDY PROGRAM
(CONTINUED)

<u>ON PROJECTS</u>	<u>NAVIGATION PROJECTS</u>	<u>RECREATION</u>	<u>POLLUTION ABATEMENT PROGRAM</u>	<u>FLOOD PLAIN REGULATION PROGRAM</u>
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areas needing local	Continue Study for Modernization of Navigation System.	Continue Recreation Studies	Continue Pollution Studies	
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-
1. Aspinwall Lock and Dam,
Allegheny River
 2. Charleroi Lock and Dam,
Monongahela River
 3. Emsworth Lock and Dam,
Ohio River

COMPLETION OF 1st PHASE

TABLE 12-26
AVERAGE ANNUAL FLOOD DAMAGES
FOR PRINCIPAL STREAM REACHES
(1969)

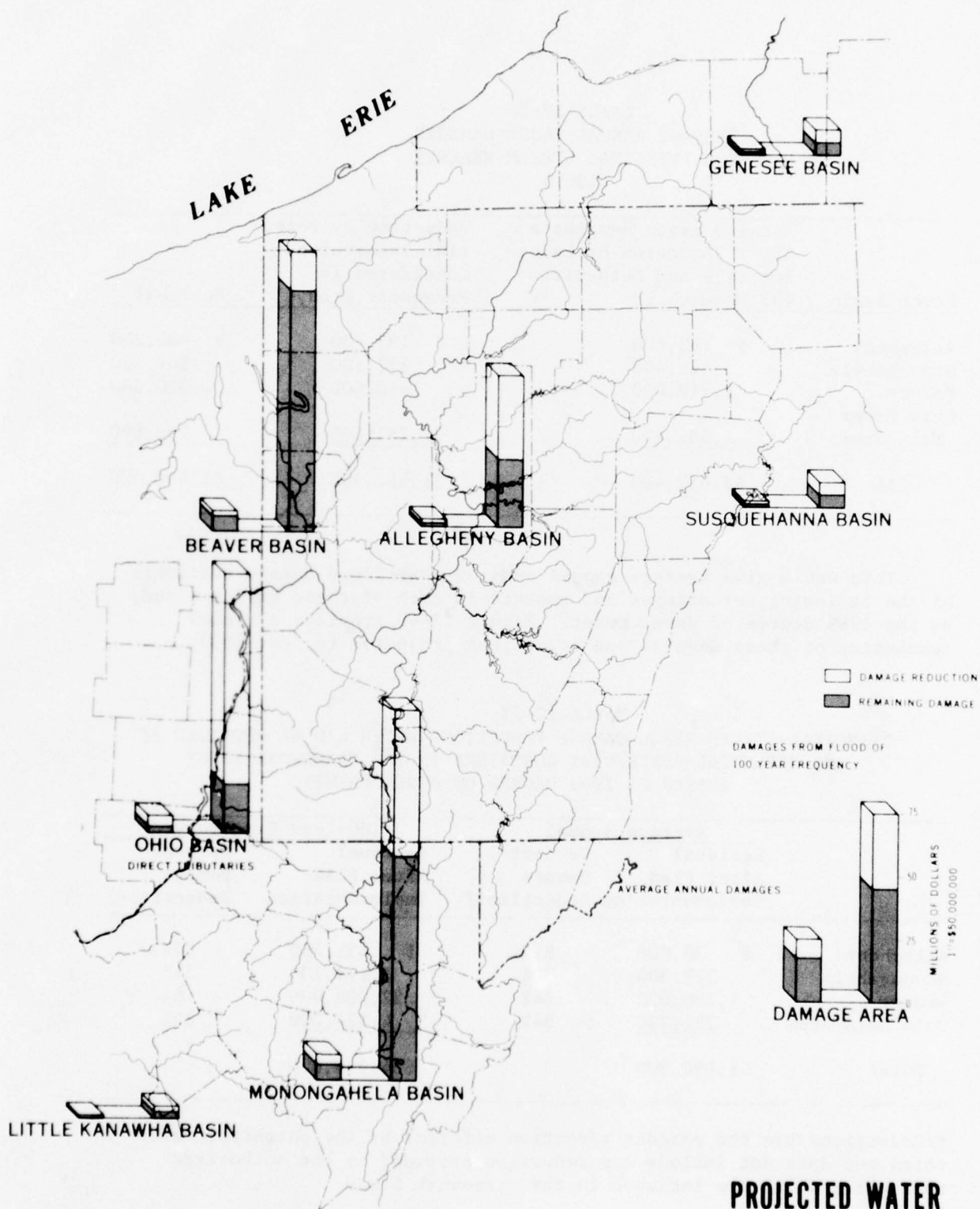
River Basin	Total Damages Remaining After Reduction by Exist- ing (13) and Authorized (5) Reservoirs	Reduction by Poten- tial Reservoirs Considered in Framework Study	Residual
Allegheny	\$ 163,600	\$ 133,400	\$ 30,200
Monongahela	446,400	137,100	309,300
Beaver	1,710,000	410,000	1,300,000
Ohio River Main Stem	1,532,400	1,281,600	250,800
TOTAL	\$3,852,400	\$1,962,100	\$1,890,300

This would give average annual and 100-year flood damage residuals of the following percentages and amounts in each of these basins based on the 1969 degree of development. Figure 12-49 provides a visual accounting of these damages and reductions projected to year 2020.

TABLE 12-27
PRINCIPAL STREAM REACH DAMAGE REDUCTIONS WHICH CAN BE PROVIDED BY
THE POTENTIAL RESERVOIRS CONTAINED IN THE FRAMEWORK STUDY
(BASED ON 1969 DEGREE OF DEVELOPMENT)

	Average Annual		100-Year Frequency	
	Residual After Plan Implementation	Percent Damage Reduction*/	Residual After Plan Implementation	Percent Damage Reduction*/
Allegheny	\$ 30,000	81%	\$ 631,700	84%
Monongahela	309,300	30%	6,919,100	54%
Beaver	1,300,000	24%	22,000,000	6%
Ohio Main Stem	251,000	84%	4,824,200	83%
TOTAL	\$1,890,300		\$34,375,000	

*/Reductions are the percent reduction afforded by the potential reservoirs and does not include the reduction provided by the authorized reservoirs which are included in the Framework Study.



The dependable flow which can be made available from each reservoir is also shown in Table 12-28. This is flow which can be depended upon for use 9 out of 10 years from each reservoir for water supply and water quality needs which may develop in areas downstream of each of these reservoirs.

General Recreation, Fish and Wildlife. The reservoirs contained in the Framework Study would provide for general recreation opportunities in excess of 18.5 million visitor-days per year based on recreation potential estimates supplied by the Bureau of Outdoor Recreation. A breakdown of these figures by individual project is given in Table 12-28.

In addition to this, the reservoirs contained in the Framework Study provide approximately one million additional fisherman days and approximately 75,000 acres of mitigation lands for wildlife management. A tabulation of the fishing days provided along with the present quality of the water and the lands needed for wildlife mitigation at each of the Framework Reservoirs, for which such information is available is shown in Table 12-29.

The implementation of all the reservoirs contained in the Framework Study would thus fulfill approximately 20 percent of the general recreation need and 14 percent of the unsatisfied hunting and fishing demand of Sub-region F in the year 2020.

TABLE 12-28

SUMMARY
CORPS OF ENGINEERS FRAMEWORK STUDY
SUB-REGION F
MULTIPLE PURPOSE RESERVOIRS
POTENTIAL

RESERVOIR SITE	LOCATION	POTENTIAL 1/ PURPOSES	DRAINAGE AREA (SQ. MI.)	POOL ELEVATION			GROSS STORAGE CAPACITY (1000 ACRE FEET)		FLOOD CONTROL STORAGE WINTER		FLOOD CONTROL STORAGE SUMMER		
				FULL	SUMMER	PERMANENT	(1000 AC FT)	(INCHES)	(1000 AC FT)	(INCHES)			
ALLEGHENY RIVER SUB-BASIN													
A-1 Upper Allegheny Sub-Division (Water Area F-1)	Area upstream of Franklin, Pa.												
a. Conewango Creek	Above Waterboro, N. Y.	FC, LF, WS, R, FWL	283.3	1281	1276	1265	100.0	6.62	76.0	5.03	56.0	3.54	
b. Cassadaga Creek	Above Gerry, N. Y.	FC, LF, WS, R, FWL	120.2	1280	1275	1265	87.5	13.65	45.5	7.06	27.0	1.71	
c. Stillwater Creek	2.0 miles above mouth	FC, LF, WS, R, FWL	47.7	1340	1328	1295	33.1	13.02	18.1	7.13	14.0	0.89	
d. Brokenstraw Creek	Above Garland, Pa.	FC, LF, WS, R, FWL	164.2	1392	1385	1340	86.0	9.83	23.0	6.05	24.0	1.51	
Total A-1			615.4				306.6		192.6		114.0	7.24	
A-2 French Creek Sub-Division (Water Area F-1)	Entire French Creek Basin												
*a. Union City	Above junction with South Branch of French Creek	FC, R	221.8	1278	1250		47.5	5.03	46.2	3.92	35.0	2.21	
*b. Woodcock Creek	4.1 miles above mouth	FC, LF, R	45.7	1209	1180	1162	20.0	6.21	18.9	7.75	14.0	0.89	
*c. Muddy Creek	9.0 miles above mouth	FC, WS, R	61.2	1205	1183		19.4	5.94	18.2	5.78	14.0	0.89	
Total A-2			329.0				86.9		84.0		70.0	4.39	
A-3 Middle Allegheny Sub-Div. (Water Areas F-1 & F-2)	Mouth of French Creek to mouth of Kiskiminetas River												
a. East Branch Mahoning Creek	0.8 mile above junction with Mahoning Creek	FC, LF, WS, R, FWL	52.0	1444	1432		42.2	15.16	24.3	8.74	14.0	0.89	
b. North Fork Creek	1.7 miles above junction with Redbank Creek	FC, LF, WS, R, FWL	96.4	1404	1387	1263	136.2	26.55	60.2	11.72	31.0	1.95	
c. Little Sandy Creek	Above junction with Redbank Creek	FC, LF, WS, R, FWL	72.7	1240	1227	1135	111.2	28.73	46.7	12.02	28.0	1.76	
d. St. Petersburg	5.0 miles above junction with Allegheny River	FC, LF, WS, R, FWL, P	1,244.6	1155	1130	937	981.0	14.78	465.9	7.02	220.0	13.91	
Total A-3			1,465.7				1,270.6		597.1		375.0	23.65	
A-4 Kiskiminetas Sub-Division (Water Areas F-2 & B-2)	Entire Kiskiminetas River Basin												
a. Yellow Creek	9.2 miles above junction with Twolick Creek	FC, LF, WS, R, FWL	52.0	1340	1336	1255	105.0	37.86	24.0	8.64	14.0	0.89	
b. Tub Mill Creek	1.5 miles above junction with Conemaugh River	FC, LF, WS, R, FWL	47.1	1180	1168	1102	59.3	23.68	28.5	11.35	14.0	0.89	
c. Clear Shade Creek	0.3 mile above mouth	FC, LF, WS, R, FWL	31.4	2240	2229	2104	35.0	20.90	18.2	10.90	4.0	0.25	
d. Upper Stony Creek	0.3 mile above Lamberts Run, near Mostoller, Pa.	FC, LF, WS, R, FWL	72.8	2200	2166	2042	35.0	9.02	23.0	5.93	14.0	0.89	
e. Fourmile Run	4.0 miles above junction with Loyahanna Creek	FC, LF, WS, R, FWL	33.7	1335	1320		47.2	26.26	20.2	11.25	4.0	0.25	
Total A-4			237.0				281.5		113.2		29.0	1.83	
TOTAL ALLEGHENY RIVER SUB-BASIN			2,647.1				1,945.6		987.6		614.0	38.81	
BEAVER RIVER SUB-BASIN													
B-1 Shenango River Sub-Division (Water Area F-1)	Entire Shenango River Basin												
a. Otter Creek	Above town of Fredonia, Pa.	FC, LF, WS, R, FWL	15.5	1154	1150	1136	22.8	27.58	9.6	11.61	4.0	0.25	
b. Little Neshannock Creek	6.5 miles above mouth	FC, LF, WS, R, FWL	10.4	1055	1050	1040	10.2	18.39	5.3	9.55	4.0	0.25	
c. West Branch - Little Neshannock Creek	0.9 mile above mouth	FC, LF, WS, R, FWL	17.0	1051	1045	1027	17.6	19.41	7.7	8.50	4.0	0.25	
Total B-1			42.9				50.6		22.6		14.0	0.89	
B-2 Remaining Portion of Beaver River Sub-Basin (Water Area F-2)													
a. Little Connoquenessing Creek	4.9 miles above mouth	FC, LF, WS, R, FWL	44.0	1038	1025	975	59.3	25.27	26.8	11.41	14.0	0.89	
b. Glade Run	0.6 mile above mouth	FC, LF, WS, R, FWL	41.0	1030	1020	984	44.3	20.26	21.6	9.87	4.0	0.25	
Total B-2			85.0				103.6		48.4		28.0	1.76	
TOTAL BEAVER RIVER SUB-BASIN			127.9				154.2		71.0		32.0	2.04	
SUBTOTAL (PAGE)			2,775.0				2,099.8		1,058.6		636.0	39.85	

^{1/} FC - Flood Control, LF - Low Flow Augmentation, WS - Water Supply, R - Recreation, FWL - Fish and Wildlife, P - Hydroelectric Power

^{2/} Amount of storage available for purposes other than flood control (Gross storage minus summer flood storage and permanent storage).

^{3/} Assured flow that over the period of record, can be released for water use purposes so that a scheduled maximum drawdown will not be exceeded nine years of ten and will enable summer

* Authorized Reservoirs, expected to be in operation by 1980.

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TABLE 12-26

SUMMARY
CORPS OF ENGINEERS FRAMEWORK STUDY
SUB-REGION F
MULTIPLE PURPOSE RESERVOIRS
POTENTIAL

GROSS STORAGE CAPACITY		FLOOD CONTROL STORAGE				SUPPLEMENTAL 2/ STORAGE		POOL AREA (ACRES)			DEFENDABLE RELEASE 3/ (CFS)	SUMMER DRAWDOWN EXCEEDED 1 IN 10 YEARS (FEET)	PROJECTED ANNUAL RECREATION VISITATION (VISITOR DAYS)	TYPE OF DAM	TYPE OF SPILLWAY	ESTIMATED COST	
(1000 ACRE FEET)	(INCHES)	(1000 AC FT)	(INCHES)	(1000 AC FT)	(INCHES)	(1000 ACRE FEET)		FULL	SUMMER	PERMANENT						TOTAL (\$1,000)	AVERAGE PER ACRE FOOT (\$)
100.0	6.62	76.0	5.03	50.0	3.31	46.0	12,100	8,000	1,390	152	4 Max.	800,000	Earth Fill	Uncontrolled, Stream Width			
87.5	13.65	45.5	7.06	27.5	4.29	39.0	6,100	4,970	2,820	66	4 Max.	497,000	Earth Fill	Uncontrolled, Stream Width			
33.1	13.02	18.1	7.13	12.3	4.85	17.3	1,310	790	285	42	8 Max.	79,000	Earth Fill	Uncontrolled, Stream Width			
<u>86.0</u>	<u>9.83</u>	<u>53.0</u>	<u>6.05</u>	<u>26.8</u>	<u>3.07</u>	<u>53.0</u>	<u>4,360</u>	<u>3,280</u>	<u>360</u>	<u>122</u>	<u>10 Max.</u>	<u>328,000</u>	Earth Fill	Uncontrolled, 200 Ft. Width			
306.6		192.6		116.6		155.3				382		1,704,000				60,000	196
47.5	1.03	46.2	3.92	39.1	3.31		2,280	580				182,000	Earth Fill	Uncontrolled, 286 Ft. Width			
20.0	8.21	18.9	7.75	15.2	6.25	3.8	775	325	125	75	17	1,000,000	Earth Fill	Uncontrolled, Sidehill			
<u>19.3</u>	<u>5.94</u>	<u>18.2</u>	<u>5.78</u>	<u>16.4</u>	<u>5.02</u>		<u>1,188</u>	<u>350</u>				<u>203,000</u>	Earth Fill	Uncontrolled, 300 Ft. Width			
86.9		84.0		70.7		3.8				75		1,385,000				37,066	427
42.2	15.16	24.3	8.74	12.8	4.61		930	680		57	12	68,000	Earth Fill	Uncontrolled, 200 Ft. Width			
136.2	26.55	60.2	11.72	35.2	6.85	98.3	2,420	1,840	1,263	110	15	184,000	Earth Fill	Uncontrolled, 100 Ft. Width			
111.2	28.73	46.7	12.02	28.2	7.27	77.4	2,540	1,690	330	80	11	169,000	Earth Fill	Uncontrolled			
<u>281.0</u>	<u>14.78</u>	<u>465.9</u>	<u>7.02</u>	<u>225.9</u>	<u>4.46</u>	<u>673.1</u>	<u>13,590</u>	<u>10,140</u>	<u>499</u>	<u>1,600</u>	<u>15 Max.</u>	<u>3,360,000</u>	Concrete	Gated, 7 - 45 Ft. Bays			
270.6		597.1		372.1		848.8				1,847		3,781,000				275,000	216
105.0	37.86	24.0	8.64	14.0	5.03		1,725	1,620		64	8	162,000	Earth Fill	Uncontrolled			
59.3	23.68	28.5	11.35	12.5	4.98	42.2	1,840	1,510	290	60	20	151,000	Earth Fill	Uncontrolled, 100 Ft. Width			
35.0	20.90	18.2	10.90	8.2	4.91	26.2	830	610	35	37	20	61,000	Rock Fill	Uncontrolled, 100 Ft. Width			
35.0	9.02	23.0	5.93	12.8	3.30	21.4	485	310	43	70	38	31,000	Earth Fill	Uncontrolled, 250 Ft. Width			
<u>47.2</u>	<u>26.26</u>	<u>20.2</u>	<u>11.25</u>	<u>9.0</u>	<u>5.01</u>		<u>1,600</u>	<u>1,380</u>		<u>45</u>	<u>20</u>	<u>138,000</u>	Earth Fill	Uncontrolled			
<u>281.5</u>	<u>113.9</u>		<u>56.5</u>			<u>82.8</u>				<u>276</u>		<u>543,000</u>				85,000	302
945.6		987.6		615.9		1,097.7				2,580		7,413,000				457,066	235
22.8	27.58	9.6	11.61	4.2	5.08	13.2	1,270	1,170	480	13	5	117,000	Earth Fill	Uncontrolled, 100 Ft. Width			
10.2	18.39	5.3	9.55	2.8	5.05	4.7	677	577	357	8	5	57,700	Earth Fill	Uncontrolled, 100 Ft. Width			
<u>17.6</u>	<u>19.41</u>	<u>7.7</u>	<u>8.50</u>	<u>4.6</u>	<u>5.07</u>	<u>9.0</u>	<u>845</u>	<u>680</u>	<u>340</u>	<u>12</u>	<u>5</u>	<u>68,000</u>	Earth Fill	Uncontrolled, 100 Ft. Width			
50.6		22.6		11.6		26.9				33		242,700				20,000	395
59.3	25.27	26.8	11.41	16.5	7.03	36.4	1,370	1,130	360	41	10	113,000	Earth Fill	Uncontrolled, 200 Ft. Width			
<u>44.3</u>	<u>20.26</u>	<u>21.6</u>	<u>9.87</u>	<u>11.8</u>	<u>5.40</u>	<u>25.9</u>	<u>1,320</u>	<u>1,080</u>	<u>380</u>	<u>34</u>	<u>10</u>	<u>108,000</u>	Earth Fill	Uncontrolled, 200 Ft. Width			
<u>103.6</u>	<u>48.4</u>		<u>28.3</u>			<u>62.3</u>				<u>75</u>		<u>221,000</u>				30,000	290
<u>154.2</u>	<u>71.0</u>		<u>39.9</u>			<u>89.2</u>				<u>108</u>		<u>463,700</u>				50,000	324
2,099.8		1,058.6		655.8		1,186.9				2,688		7,876,700				507,066	241

exceeded nine years of ten and will enable summer pool to be reached a majority of the time.

2

RESERVOIR SITE	LOCATION	POTENTIAL 1/ PURPOSES	DRAINAGE AREA (SQ. MI.)	FULL POOL ELEVATION	SEASON PERMANENT	SHOWN STORAGE CAPACITY (1000 ACR. FEET)	(INCHES)	WINTER (1000 AC. FT.)	FEET
MONONGAHELA RIVER SUB-BASIN									
M-1 Tygart River Sub-Division (Water Area G-1)	Entire Tygart River Basin								
a. Teter Creek	0.5 mile above Martinsville, W. Va.	FC, LF, WS, R	49.0	1438	1430	1308	86.2	32.98	50.2
b. Laurel Creek	0.3 mile above junction with Tygart River	FC, LF, WS, R	52.4	1564	1557	1436	79.5	21.29	17.4
c. Buckhannon River	Downstream of Hempton, W. Va.	FC, LF, WS, R, FWL	181.9	1495	1483	1445	184.0	19.04	106.0
d. Middle Fork River	0.4 mile downstream from mouth of Hanging Run	FC, LF, WS, R, FWL	144.6	1950	1941	1800	327.0	42.50	105.0
e. Upper Tygart River	1.5 miles above Lee Bell, W. Va.	FC, LF, WS, R, FWL, F	80.6	2300	2287	2165	126.7	30.80	45.0
Total M-1			508.5				799.4		371.6
M-2 West Fork River Sub-Division (Water Area F-3)	Entire West Fork River Basin								
a. Ten Mile Creek	2.2 miles below Gardis, W. Va.	FC, LF, WS, R	70.2	1000	983	962	40.0	10.70	35.2
b. Elk Creek	0.4 mile above Quiet Mill, W. Va.	FC, LF, WS, R	75.8	1050	1053	1014	85.6	21.19	34.6
c. Hackers Creek	4.9 miles above Jane Low, W. Va.	FC, LF, WS, R	30.0	1073	1067	1030	28.3	17.50	12.1
*d. Stonewall Jackson	At Brownsville, W. Va.	FC, LF, WS, R, FWL	101.8	1082	1073	1034	75.2	13.85	30.2
Total M-2			277.8				229.1		121.1
M-3 Upper Cheat River Sub-Div. (Water Areas F-3 & G-5)	Cheat River Basin above Bowlesburg Dam								
*a. Bowlesburg	Above Bowlesburg, W. Va.	FC, LF, WS, R, FWL, F	935.8	1632	1601	1420	831.7	16.66	299.6
Total M-3							831.7		299.6
M-4 Youghiogheny River Sub-Div. (Water Areas F-3, B-2 & B-3)	Entire Youghiogheny River Basin								
a. Laurel Hill Creek	Above town of Ursina, Pa.	FC, LF, WS, R, FWL	124.8	1580	1567	1376	233.7	35.14	81.2
b. Upper Casselman River	1.5 miles above Salisbury, Pa.	FC, LF, WS, R, FWL	71.5	2176	2166	2066	86.7	22.70	33.9
c. Upper Youghiogheny River	Above Crellin, Md.	FC, LF, WS, R	54.2	2458	2455	2423	145.3	49.68	80.6
Total M-4			251.2				465.7		207.7
M-5 Monongahela River Sub-Div. (Water Areas F-2 & F-3)	Area from junction of Tygart and West Fork Rivers to Mouth of Monongahela River including Lower Cheat River below Bowlesburg Dam								
a. Dunkard Creek	1 mile above junction with Monongahela River	FC, WS, R	228.1	910	867	825	66.2	5.44	60.9
b. Big Sandy Creek	1.3 miles downstream from Clifton Mills, W. Va.	FC, LF, WS, R, FWL	120.2	1644	1637	1460	144.0	45.57	120.0
Total M-5			419.0				330.2		189.9
TOTAL MONONGAHELA RIVER SUB-BASIN			2,392.3				2,846.1		1,141.9
UPPER OHIO RIVER SUB-BASIN									
G-1 Pittsburgh to New Martinsville, W. Va. (Water Area F-2)									
a. Raccoon Creek	Below town of Independence, Pa.	FC, LF, WS, R, FWL	147.0	900	892	815	152.4	19.83	52.9
TOTAL UPPER OHIO RIVER SUB-BASIN							152.4		52.9
LITTLE KANAWHA RIVER SUB-BASIN									
K-1 Portion of Little Kanawha River Sub-Basin in Sub-Region F (Water Area F-3)									
a. Leading Creek	0.5 mile above mouth	FC, LF, R	146.0	776	757	731	62.6	8.00	20.6
TOTAL LITTLE KANAWHA RIVER SUB-BASIN							62.6		20.6
GENESSEE RIVER SUB-BASIN									
G-1 Portion of Genessee River Sub-Basin in Sub-Region F (Water Area F-1)									
a. Standard	3.5 miles above Wellsville, N. Y.	FC, LF, WS, I, R, FWL	168.0	1620	1620		21.5	10.44	-
TOTAL GENESSEE RIVER SUB-BASIN							21.5		-
LAKE ERIE SUB-BASIN									
E-1 Cattaraugus Creek Sub-Division (Water Area F-1)									
a. Zoar	Above Gowanda, N. Y.	LF, I, R, F	318.0	1120	1120		140.0	20.05	-
b. Otto	Above Otto, N. Y.	LF, I, R	64.4	1365	1365		126.5	36.83	-
c. Springville	Below Springville, N. Y.	LF, I, R, F	204.3	1290	1290		252.0	23.40	-
TOTAL LAKE ERIE SUB-BASIN			586.7				518.5		-
TOTAL PLAN			6,215.0				5,916.9		2,309.0

1/ FC - Flood Control, LF - Low Flow Augmentation, WS - Water Supply, I - Irrigation, R - Recreation, FWL - Fish and Wildlife, F - Hydroelectric Power
 2/ Amount of storage available for purposes other than flood control from summer pool to the top of the permanent pool.
 3/ Assured flow that over the period of record, can be released for water use purposes so that a scheduled maximum drawdown will not be exceeded nine years of ten and will be
 4/ Authorized Reservoirs, expected to be in operation by 1980.
 5/ 1000 cfs Tuesday through Friday

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TABLE 12-28

STUDY
COMMITTEE OF ENGINEERS' FRAMEWORK STUDY
SUB-REGION F
MULTIPLE PURPOSE RESERVOIRS
POTENTIAL
(CONTINUED)

POOL ELEVATION DUR. SUMMER PERMANENT	GROSS STORAGE CAPACITY (1000 ACRE FEET) (INCHES)		FLOOD CONTROL STORAGE WINTER (1000 AC FT) (INCHES)		SUPPLEMENTAL 2/ STORAGE (1000 ACRE FEET) (INCHES)		POOL AREA (ACRES) DUR. SUMMER PERMANENT		DEMANDABLE RELEASE 2/ (CFS)	DANGER EXCEEDED 1 IN 10 YEARS (FEET)	PROJECTED ANNUAL RECREATION VISITATION (VISITOR DAYS)	TYPE OF DAM	TYPE OF SPILLWAY	ESTIMATE COST	
	TOTAL (\$1,000)	AVERAGE PER ACRE FOOT (\$)													
1438 1430 1308	86.2	32.98	50.2	19.21	10.2	3.91	73.0	1,370 1,280 170	104	39	128,000	Earth Fill	Uncontrolled, 100 Ft. Width		
1504 1557 1436	79.5	21.29	17.4	6.24	8.4	3.01	50.1	1,250 1,120 40	200	No Limit	112,000	Earth Fill	Uncontrolled, 100 Ft. Width		
1495 1453 1445	184.0	19.04	106.0	10.90	58.0	5.98	93.0	4,780 3,820 1,410	232	15	382,000	Earth Fill	Uncontrolled, 150 Ft. Width		
1950 1941 1800	327.0	42.50	105.0	13.65	45.0	5.84	278.0	5,150 4,770 200	290	14	477,000	Earth Fill	Uncontrolled, 150 Ft. Width		
2300 2287 2165	132.7	30.80	52.0	10.47	21.7	5.06	106.0	1,760 1,590 400	110	15	122,000	Earth Fill	Uncontrolled, 100 Ft. Width		
	789.4		323.6		143.3		600.1		936		1,258,000			160,000	203
1000 983 960	40.0	10.70	35.2	9.43	19.5	5.21	12.5	1,410 830 420	72	29	83,000	Earth Fill	Uncontrolled, 200 Ft. Width		
1060 1053 1014	85.6	21.19	34.6	8.57	21.6	5.35	57.7	3,350 2,710 530	58	5	271,000	Earth Fill	Uncontrolled, 200 Ft. Width		
1073 1067 1030	28.3	17.66	12.1	7.56	5.8	3.62	20.8	1,130 1,000 80	23	6	100,000	Earth Fill	Uncontrolled, 100 Ft. Width		
1082 1073 1034	12.2	13.85	32.2	7.28	27.0	4.97	46.2	3,290 2,530 200	25	5.5	252,000	Concrete	Uncontrolled, 3 - 35 Ft. Bays		
	229.1		121.1		73.9		137.2		208		707,000			90,000	393
1632 1601 1420	821.7	16.66	292.6	6.01	250.8	5.03	571.5	9,140 7,175 550	100	7	3,500,000	Earth Fill	Gated, 7 - 45 Ft. Bays	102,000	123
	831.7		299.6		250.8		571.5		100		3,500,000			102,000	123
1580 1567 1376	233.7	35.14	81.2	12.21	27.2	4.09	203.5	2,140 1,990 180	219	30	199,000	Earth Fill	Uncontrolled, 200 Ft. Width		
2176 2166 2066	86.7	22.70	33.9	8.90	15.1	3.95	68.3	1,680 1,440 210	116	15	144,000	Earth Fill	Uncontrolled, 200 Ft. Width		
2458 2455 2423	142.3	49.68	38.6	31.60	15.8	5.39	103.3	5,540 5,150 1,600	400	20	515,000	Concrete	Uncontrolled, 200 Ft. Width		
	465.7		207.7		58.1		375.1		735		858,000			120,000	258
910 867 825	66.2	5.44	60.9	5.01	40.9	4.02	14.8	1,820 620 150	55	0	60,000	Earth Fill	Gated, 200 Ft. Width		
1644 1637 1460	424.0	45.97	129.0	12.68	42.0	4.82	412.0	7,500 6,700 100	289	13	670,000	Earth Fill	Uncontrolled, 200 Ft. Width		
	530.2		199.2		97.2		426.8		344		732,000			80,000	151
	2,846.1		1,141.9		624.0		2,110.7		2,323		7,055,000			552,000	194
900 892 815	152.4	19.83	55.2	7.15	27.5	3.52	122.8	4,640 3,140 470	100	10	314,000	Earth Fill	Uncontrolled, 150 Ft. Width		
	155.4		55.9		27.5		122.8		100		314,000			40,000	257
776 757 731	62.6	8.02	52.6	6.74	22.4	4.54	22.8	2,350 1,375 475	111		522,500	Earth Fill	Uncontrolled, 300 Ft. Width		
	62.6		52.6		35.4		22.8		111		522,500			22,000	351
1620 1620	22.5	10.44	-	-	-	-	-	2,330 2,330			403,000	Earth Fill	Gated, 4 - 47.5 Ft. Bays		
	93.5										403,000			35,000	374
1120 1120	340.0	20.05	-	-	-	-	-	4,150 4,150		9 Max.	911,410	Concrete	Gated, 6 - 50 Ft. Bays		
1365 1365	126.5	36.83	-	-	-	-	-	4,450 4,450		4 Max.	1,015,540	Earth Fill	Uncontrolled		
1290 1290	252.0	23.40	-	-	-	-	-	4,150 4,150		14 Max.	526,540	Concrete & Earth Fill	Gated		
	721.5										2,463,490			450,000	624
	5,916.9		2,309.0		1,342.7		3,443.2		5,222		18,634,690			1,606,066	269

and Wildlife, P - Hydroelectric Power
of pool.
max drawdown will not be exceeded nine years of ten and will enable summer pool to be reached a majority of the time.

11-12-211

2

TABLE 12-29
DATA ON FISH AND WILDLIFE POTENTIAL
FOR RESERVOIRS INCLUDED IN
FRAMEWORK STUDY

Name	Area	Existing Water Quality	Additional Fisherman Days Provided by Project ^{1/}	Lands Needed For Wildlife Mitigation (acres)
Little Sandy Creek	F-1&2	Good, Ph-7.5-7.6	28,000	1,600 - 3,000
North Fork	F-1	Good, Ph-7.3-7.4	24,000	1,400 - 2,200
Tub Mill Creek	F-2	Good, Ph-6.8	13,000	600 - 800
Clear Shade Creek	B-2	Good, Ph-6.7	8,000	400 - 600
Upper Stony Creek	B-2	Marginal, Ph-5.8	10,000	600 - 800
Little Connoquenesing Creek	F-2	Marginal to Good	21,000	800 - 1,200
Glade Run	F-2	Good, Ph-7.6-7.7	25,000	1,000 - 1,600
Laurel Hill Creek	B-2	Good, Ph-7.0	18,000	1,400 - 2,200
Upper Casselman River	B-2&B-3	Marginal, Ph-6.8	19,000	1,200 - 2,000
Upper Youghiogheny	F&B-3	Good, Ph-6.8	68,000	5,400 - 8,000
Teter Creek	G-5	Good	10,000	1,200 - 2,000
Laurel Creek	G-5	Marginal to Good	15,000	1,400 - 2,200
Buckhannon River	G-5	Good	45,000	4,600 - 6,800
Middle Fork River	G-5	Marginal, Ph-6.2	36,000	4,400 - 6,400
Upper Tygart River	G-5	Good, Ph-7.5	8,000	1,600 - 2,400
Elk Creek	F-3	Unsatisfactory	28,000	1,600 - 2,400
Ten Mile Creek	F-3	Unsatisfactory	21,000	600 - 1,000
Big Sandy Creek	F-2&3	Satisfactory	58,000	3,000 - 4,600
Dunkard Creek	F-2	Unsatisfactory	33,600	1,400 - 2,200
Cassadaga Creek	F-1	Good	78,750	3,200 - 5,000
Conewango Creek	F-1	Good	44,000	8,500 - 10,000
Brokenstraw Creek	F-1	Good	18,800	300 - 500
Raccoon Creek	F-2	Unsatisfactory	63,800	2,000 - 4,000
Stillwater Creek	F-1	Good	--	-- - --
St. Petersburg	F-1	Ph-4.3-5.3	149,000	10,500
Yellow Creek	F-2	Good, Ph-6.8-7.2	--	--
Otter Creek	F-1	Good	--	--
Little Neshannock Creek	F-1	Good, Ph-7.0-8.5	--	--
West Branch - Little Neshannock	F-1	Good	--	--
Hackers Creek	F-3	Good, Ph-6.7-7.4	--	--
Stannard	F-1	Good	156,200	--
Zoar	F-1	Good	81,410	--
Otto	F-1	Good	132,980	--
Springville	F-1	Good	107,340	--

^{1/} Benefits are based on the premise that the streams with unsatisfactory water quality will be cleaned up by means of a pollution abatement program which must be implemented as part of the reservoir construction plan at that particular site.

Hydroelectric Power. Existing hydroelectric power installations in Sub-region F produce a small percentage of the overall power requirements for residential, agricultural, commercial, industrial and other consumers. Although in terms of total electric energy production, the contribution of hydropower is small, alternative forms of conventional steam power generation of peak demand would be more costly. Flexibility of operation of hydropower plants allows production of such energy to be fed into the distribution system on short notice to satisfy periods of heavy demand or in emergencies where thermal-electric facility operation would be expensive and slow acting. The steam-electric plants in the sub-region, in general, have the advantage of low-cost fuel and transportation, proximity to adequate water supply for cooling purposes, and location near the load centers. Long transmission lines are not required. Past experience in the area indicates that all of the base load and part of the peak load can be carried most economically by steam-electric generation, with the remainder of the peak load carried either by steam-electric stations reserved for the purpose or by peak-load hydroelectric stations.

Hydropower developments in the basin are under construction at the Allegheny Reservoir and in an advanced stage of planning at the authorized Rowlesburg (Cheat River) Reservoir. Studies indicate that a pumped storage or a conventional power plant would be economically justified at St. Petersburg Reservoir Site, and that pumped storage power is also a possibility at the potential Zoar (or Springville) Reservoir Sites. These plants would have the following hydroelectric capabilities:

<u>Reservoir Site</u>	<u>Type of Facility</u>	<u>Installed Capacity, mw</u>
Allegheny Reservoir	Pumped storage	357.5
Rowlesburg	Pumped storage	350
St. Petersburg	Pumped storage	420
Zoar	Pumped storage	912

Preliminary investigations indicate that the Upper Tygart and Springville Sites (which have been included as part of the Framework Study) and three sites in the Cheat River Basin, Beaver Hole, Laurel-Glady Fork and Canaan Valley have extremely high potential for development of hydroelectric power.

No studies have been made of the Upper Tygart and Springville Sites to determine type and size of a potential power plant, but the potential Cheat River Basin Sites have been studied by the Federal Power Commission in an appraisal report written in 1965 entitled "Water Resource Appraisals for Hydroelectric Licensing, Cheat River Basin, Pennsylvania-West Virginia" and were found to have the following potential hydroelectric power capabilities:

<u>Reservoir Site</u>	<u>Installed Capacity*/ (mw)</u>	<u>Average Annual Generation (mw-hrs)</u>
Canaan Valley	525	400,000
Beaver Hole	450	620,000
Laurel-Glady	60	66,000

*/ All reversible pumped-storage units except 300 kilowatts at Beaver Hole.

Hydropower development may be both possible and economically feasible at some of the other reservoir sites contained in the Framework Study, but at the present time no studies have been made in regard to this possibility.

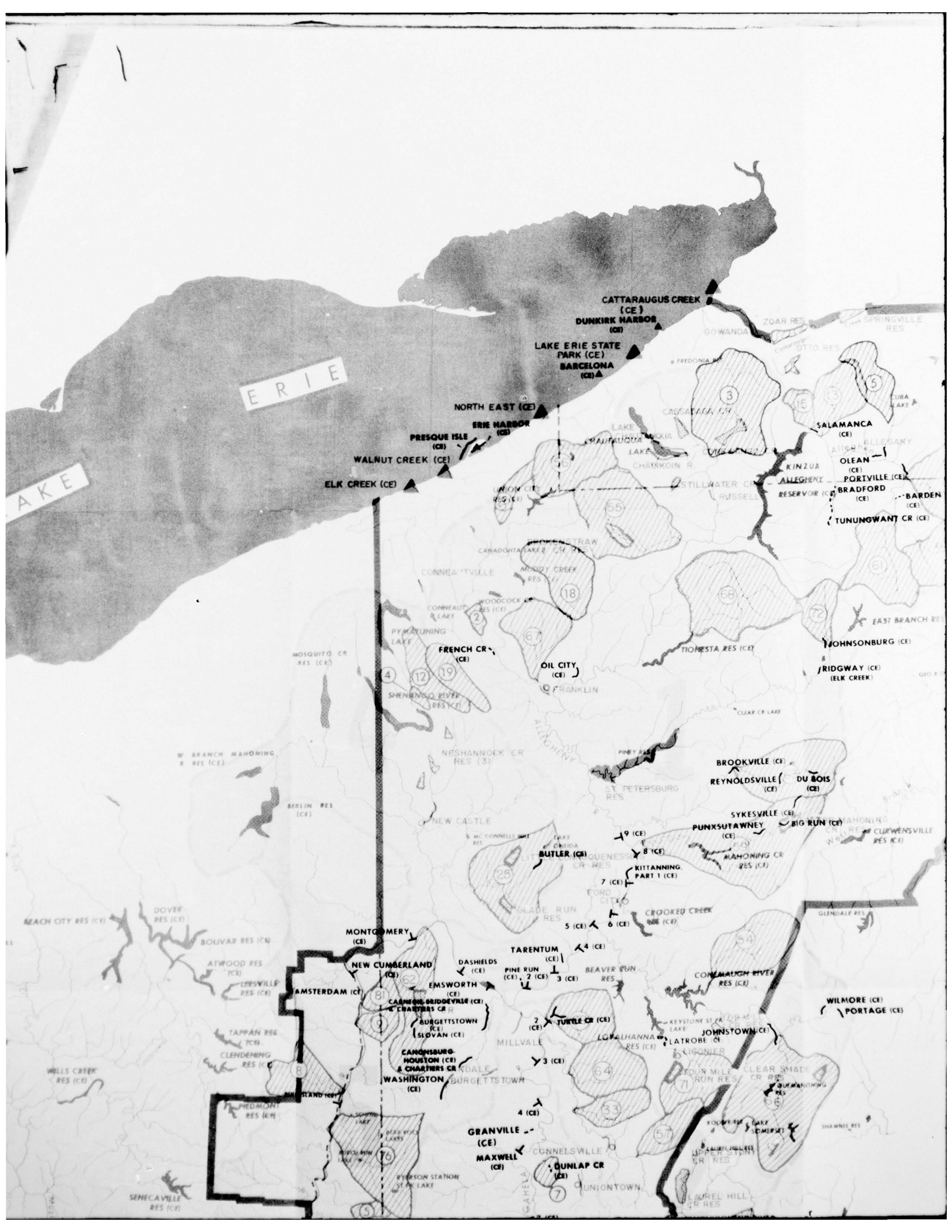
Estimated Costs

The following tabulation summarizes the estimated first cost of the potential projects on a combined basis for each major basin. Cost estimates have been made in sufficient detail for the purpose of this preliminary report for most of the potential local flood protection projects and the system of potential multi-purpose reservoirs which have been included in this study. The construction costs of the channel improvement projects are based on estimates of the major cost items of rock and common excavation, bridge protection, clearing, and relocation of known pipe crossings. Quantity estimates are based on data obtained from USGS Maps (7-1/2' quadrangle, scale 1" = 24,000 feet). The construction costs of the potential reservoirs include the cost of lands and damages, dam and appurtenances, reservoir clearing, recreation facilities and known relocations.

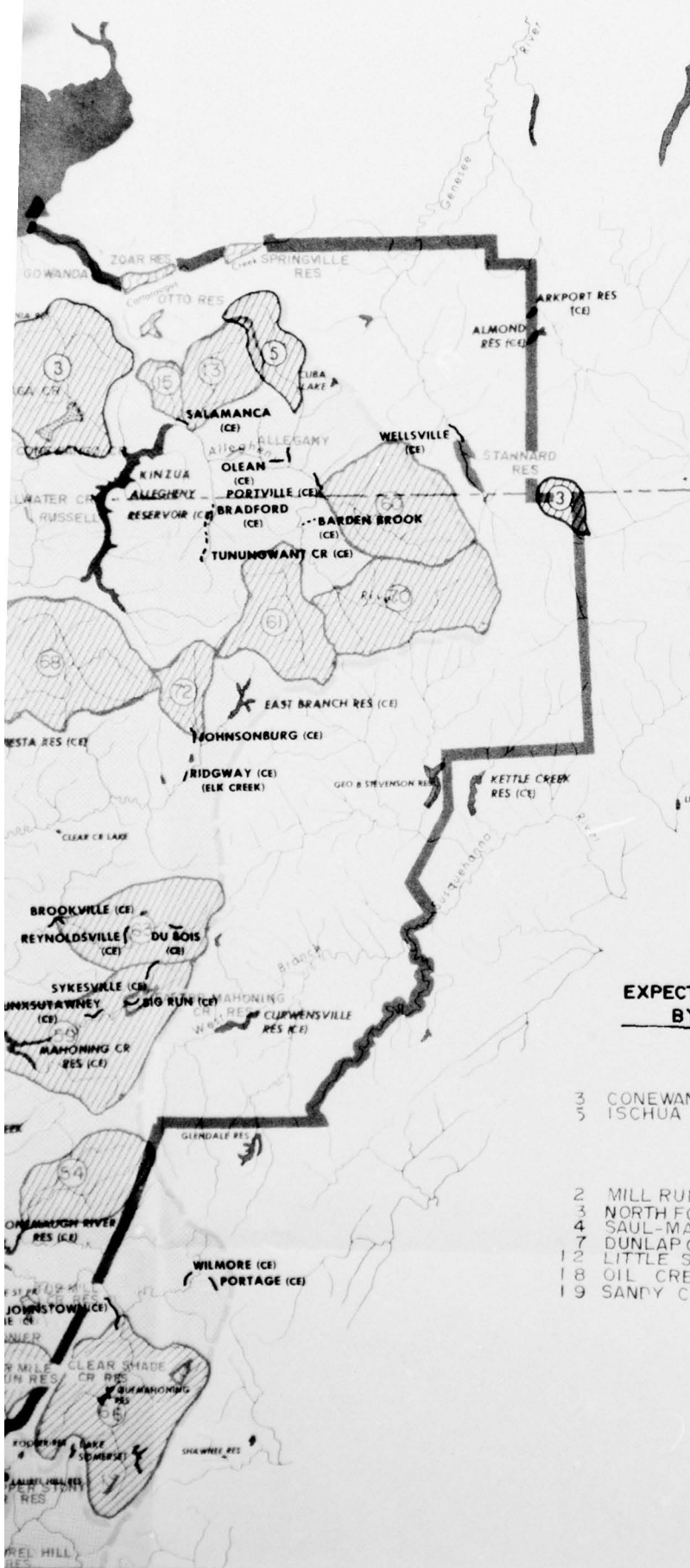
TABLE 12-30
ESTIMATED CAPITAL INVESTMENT COSTS REQUIRED TO IMPLEMENT
POTENTIAL PROJECTS INCLUDED IN THE
FRAMEWORK STUDY*/

Basin	Total Capital Investment Implementation Costs (Millions of Dollars)		
	Reservoirs	Local Protection	Total
Allegheny River Basin	460	\$ 80	\$ 540
Monongahela River Basin	550	10	560
Beaver River Basin	50	5	55
Ohio River Main Stem & Main Tributaries	40	100	140
Genesee	38	-0-	38
Cattaraugus	420	1	421
Susquehanna	-0-	-0-	-0-
Little Kanawha	25	-0-	25
SUB-TOTAL	1,583	\$196	\$1,779
Navigation (Total for sub-region)			375
TOTAL COST, FRAMEWORK STUDY			\$2,154

*/ Does not include costs of U. S. Department of Agriculture's part of the Plan.



2



UPSTREAM WATERSHED PROJECTS IDENTIFICATION

EXPECTED TO EXIST
BY 1980

FOR CONTINUING
PLANNING

NEW YORK

- 3 CONEWANGO CREEK
- 5 ISCHUA CREEK

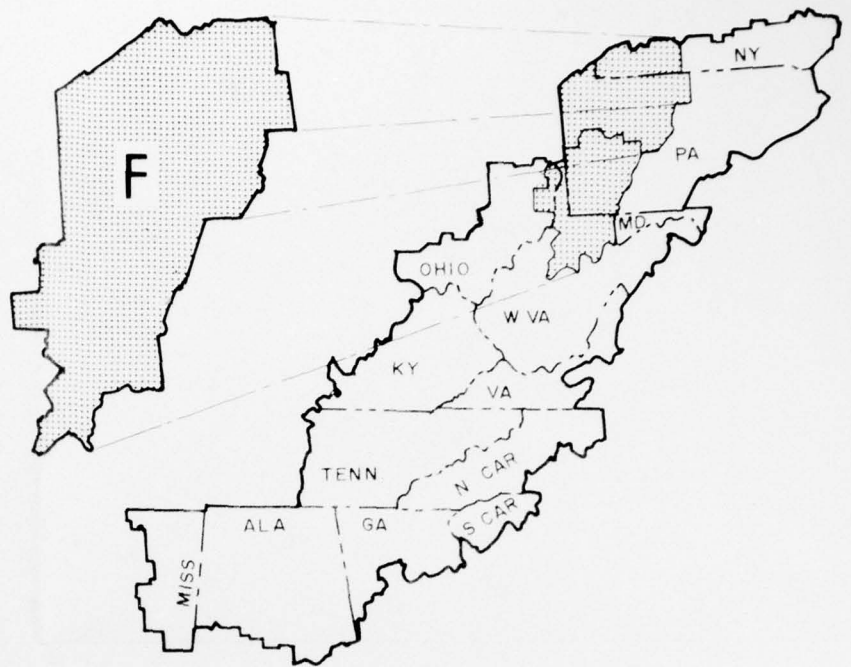
- 13 GREAT VALLEY CREEK
- 15 LITTLE VALLEY CREEK

PENNSYLVANIA

- 2 MILL RUN CREEK
- 3 NORTH FORK COWANESQUE RIVER
- 4 SAUL-MATHAY CREEK
- 7 DUNLAP CREEK
- 12 LITTLE SHENANGO RIVER
- 18 OIL CREEK
- 19 SANDY CREEK

- 25 CONNOQUENESSING CREEK
- 33 JACOBS CREEK *
- 54 BLACKLICK CREEK **
- 55 BROKENSTRAW CREEK *
- 56 UPPER FRENCH CREEK *
- 57 INDIAN CREEK
- 58 LE BOEUF CREEK
- 59 MAHONING CREEK
- 60 OSWAGO CREEK
- 61 POTATO CREEK
- 62 RACCOON CREEK
- 63 SANDY LICK CREEK
- 64 SE WICKLEY CREEK **
- 66 STONY CREEK **
- 67 SUGAR CREEK
- 68 TIONESTA CREEK
- 69 TURTLE CREEK
- 70 UPPER ALLEGHENY RIVER
- 71 UPPER LOYALHANNA RIVER
- 72 WEST BRANCH CLARION RIVER

WEST VIRGINIA



VICINITY MAP

STRUCTURAL

HARBOR



EXISTING



POTENTIAL

PROJECTS IDENTIFICATION

FOR CONTINUING PLANNING

- 13 GREAT VALLEY CREEK *
- 15 LITTLE VALLEY CREEK *

UPSTREAM WATERSHED PROJECT



EXPECTED TO EXIST BY 1980 ✓



FOR CONTINUING PLANNING

- 25 CONNOQUENESSING CREEK **
- 33 JACOBS CREEK *
- 54 BLACKLICK CREEK **
- 55 BROKENSTRAW CREEK *
- 56 UPPER FRENCH CREEK **
- 57 INDIAN CREEK
- 58 LE BOEUF CREEK
- 59 MAHONING CREEK
- 60 OSWAGO CREEK
- 61 POTATO CREEK
- 62 RACCOON CREEK
- 63 SANDY LICK CREEK
- 64 SEWICKLEY CREEK **
- 66 STONY CREEK **
- 67 SUGAR CREEK
- 68 TIONESTA CREEK
- 69 TURTLE CREEK
- 70 UPPER ALLEGHENY RIVER
- 71 UPPER LOYALHANNA RIVER CREEK
- 72 WEST BRANCH CLARION RIVER

MAJOR RESERVOIR



EXPECTED TO EXIST BY 1980 ✓



FOR AUTHORIZATION



FOR CONTINUING PLANNING 1980-1990

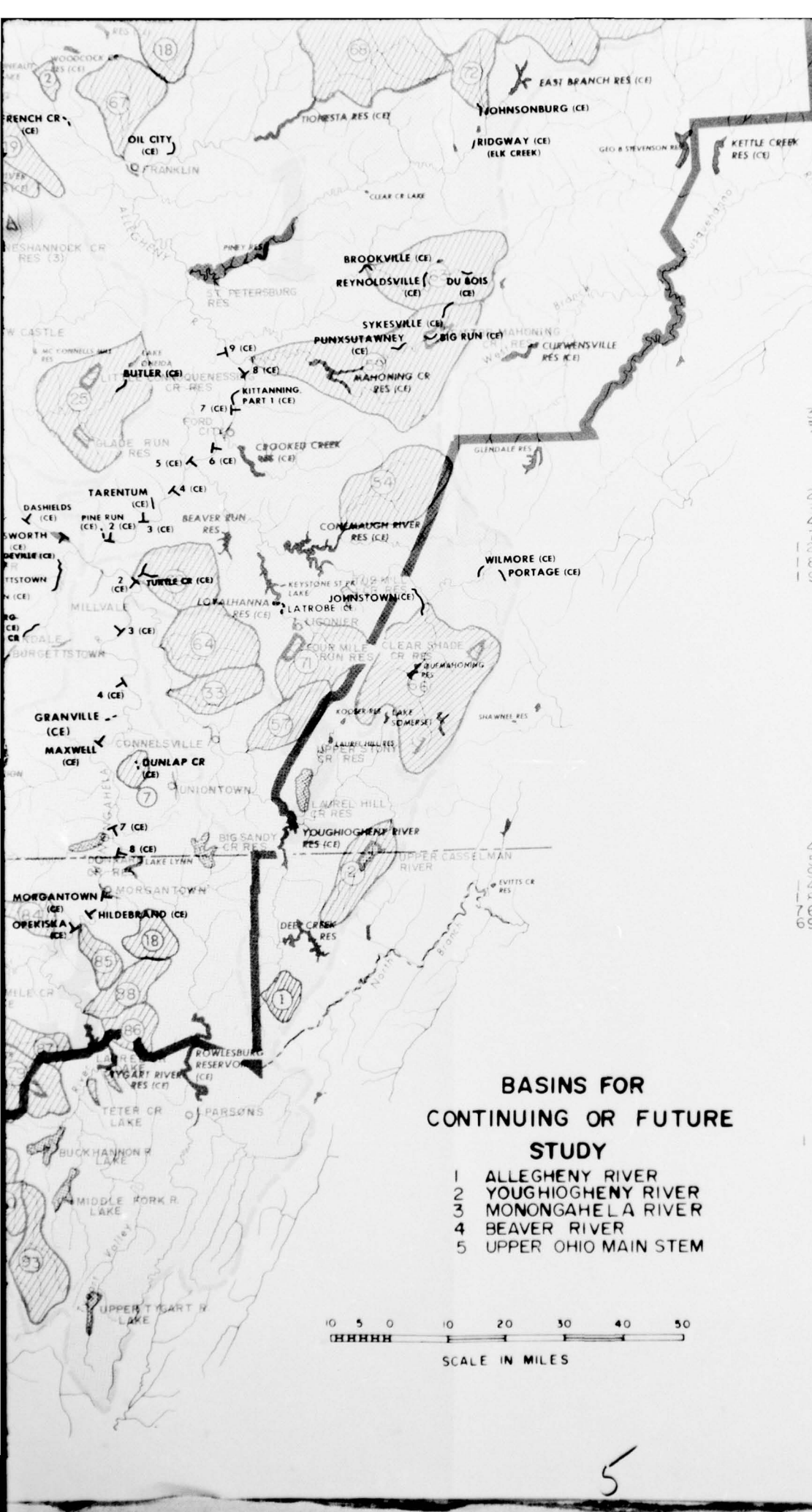


FOR CONTINUING PLANNING 1990-2010

LOCAL PROTECTION PROJECT



11



UPSTREAM WATERSHED PROJECT

EXPECTED TO EXIST
BY 1980

NEW YORK

- 3 CONEWANGO CREEK
- 3 ISCHUA CREEK

PENNSYLVANIA

- 2 MILL RUN CREEK
- 3 NORTH FORK COWANESQUE RIVER
- 4 SAUL-MATHAY CREEK
- 7 DUNLAP CREEK
- 12 LITTLE SHENANGO RIVER
- 18 OIL CREEK
- 19 SANDY CREEK

WEST VIRGINIA

- 4 SALEM FORK-TEN MILE CREEK
- 5 UPPER GRAVE CREEK
- 9 HARMON CREEK
- 14 POLK CREEK
- 18 UPPER DECKERS CREEK
- 76 WHEELING CREEK
- 69 UPPER BUFFALO CREEK

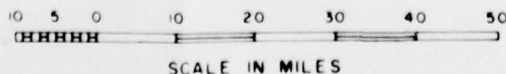
OHIO

MARYLAND

- 1 LITTLE YOUGHIOGHENY RIVER

BASINS FOR CONTINUING OR FUTURE STUDY

- 1 ALLEGHENY RIVER
- 2 YOUGHIOGHENY RIVER
- 3 MONONGAHELA RIVER
- 4 BEAVER RIVER
- 5 UPPER OHIO MAIN STEM



* RECOMMENDED FOR EARLY ACTION
* * RECOMMENDED FOR EARLY ACTION
AUTHORIZATION FOR WORK PLAN PR

NOTE:

1/ INCLUDES EXISTING ELEMENTS
(SEE FIGURE 11-17 FOR DISTRIBUTION)

5

STRUCTURAL**HARBOR**

EXISTING



POTENTIAL

OBJECTS IDENTIFICATION**FOR CONTINUING
PLANNING**

13 GREAT VALLEY CREEK *

15 LITTLE VALLEY CREEK *

25 CONNOQUENESSING CREEK **

33 JACOBS CREEK *

54 BLACKLICK CREEK **

55 BROKENSTRAW CREEK *

56 UPPER FRENCH CREEK **

57 INDIAN CREEK

58 LE BOEUF CREEK

59 MAHONING CREEK

60 OSWAGO CREEK

61 POTATO CREEK

62 RACCOON CREEK

63 SANDY LICK CREEK

64 SEWICKLEY CREEK **

66 STONY CREEK **

67 SUGAR CREEK

68 TIONESTA CREEK

69 TURTLE CREEK

70 UPPER ALLEGHENY RIVER

71 UPPER LOYALHANNA RIVER CREEK

72 WEST BRANCH CLARION RIVER

UPSTREAM WATERSHED PROJECT

EXPECTED TO EXIST BY 1980 ✓



FOR CONTINUING PLANNING

MAJOR RESERVOIR

EXPECTED TO EXIST BY 1980 ✓



FOR AUTHORIZATION



FOR CONTINUING PLANNING 1980-1990



FOR CONTINUING PLANNING 1990-2010

LOCAL PROTECTION PROJECT

EXISTING BY 1980 ✓



FOR CONTINUING PLANNING

NON-STRUCTURAL**FUTURE STUDY**(ONLY EMPHASIS
LIMITS SHOWN)

REPORT FOR

DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB - REGION F

PLAN OF DEVELOPMENT

OFFICE OF APPALACHIAN STUDIES

JUNE 1969

II-12-217

FIGURE 12-50

6

ION
CTION AND
N PREPARATION

MENTS
(EXTINCTION)